the OIL AND GAS JOURNAL
PUBLISHED WEEKLY May 9, 1960

Oil profits: They're coming harder now ▸ 95
First-quarter reports show depressed prices are limiting gains in earnings for oil companies

Ike gives FPC a new look ▸ 97

They'll graduate marketers at TU ▸ 106

Needed: Basic research in drilling ▸ 127

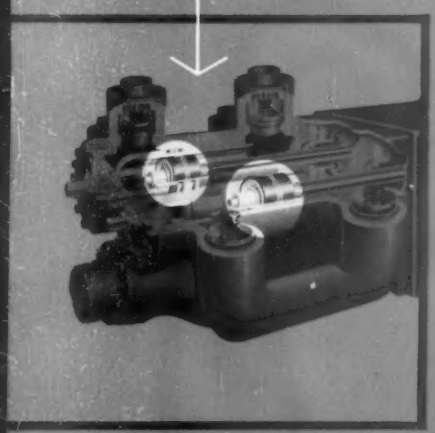
New solvent CO_2 - removal process ▸ 146

Six Small Independents Team up – to share the cost of a crack at bigger stakes

p. 102

the name Mission here

is your guarantee of real savings here



Take a good look at this Mission piston. Mission was first with this design, although today you'll see other pistons made to look like it. You see, the engineering advances that have gone into Mission pistons have made them the standard by which all others are judged.

Replaceable rubbers, long-life rubber compounds, special fabric backing, one-piece forged steel bodies, hardened piston flanges, close tolerances, wear groove in piston body flanges, API taper for piston bore, and easy and reliable snap rings and end plates are some of the specific reasons Mission pistons are superior.

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By L. W. Ledgerwood, Jr.

This is a review of all past and current developments in the drilling of oil and gas wells. Some were marked for failure immediately, some belong in the so-so class, while others show great promise. But they are all here, and a study of this experience could lead to a major breakthrough in drilling methods and technology.

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By R. W. Sheets

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American Oil Co. soon will build the world's largest crude unit, plus big new catalytic cracking and alkylation units at the plant.

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Production

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By Greg Ireton

What does it take to get a bank loan on your production? What are the current trends in oil and gas financing? This article answers these questions and discusses some basic banking philosophy.

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Here is a chart showing the general movement of natural gas through various channels of regulation into its final use.

The OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
May 9, 1960

Texans have their axes out for more import cuts:

Militant group of independents, headed by TIPRO, meets in Washington today to polish up their plea for further cuts in the import program.

They'll get a May 10 hearing before Interior officials.

Decision to press the issue was made by TIPRO and other local producer groups despite absence from their ranks of the only national organization of independents—IPAA.

Their line of argument: Current curbs have not accomplished what they were intended to do. Evidence of this are unsteady levels of domestic production, crude-price cuts, high stocks, depressed exploration and drilling activities, and a growing foreign trade deficit.

Texans plan to urge restoring the 16.6% ratio. And TIPRO will reiterate its traditional approval of a tariff as the better approach to the problem.

Notes from two important guests at TIPRO gathering last week in Tyler:

...Sheikh Abdulla Tariki of Saudi Arabia spells out his plan to stabilize world oil prices by international market-demand proration (p. 99).*

Dr. Juan Pablo Perez Alfonzo of Venezuela says the new Venezuelan government oil company will drill its first well within 6 months. Its ultimate aim is to become a completely integrated oil company (p. 98).

▼ ▼ ▼

The Washington beat:

Congressional probe of FPC is scheduled to resume Tuesday. President's appointment of two new FPC members may be dragged in. Hearing had been slated for last week but was delayed because the subcommittee was still involved in TV "payola."

Eisenhower is trying to stir up action on his proposed gasoline tax hike. He listed the need for a one-half-cent

---

*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

increase in a message to Congress last week, urging action on his legislative recommendations. But congressional vote this year still is unlikely.

Strategy behind President's surprise nominations to the FPC: Sidestep an approaching battle over Connole. Report is that Ike was irked by mounting political pressure, hastily picked two total strangers to the industry.

Sweeney and Donegan are both government lawyers who had been cleared for higher jobs and, more important, had no connection with the oil or gas industry (p. 97).

▼ ▼ ▼

A lightweight but deep-drilling rig with several eyebrow-raising features is being assembled at Houston this week for eventual transport into central Bolivia by plane.

California Standard and Shell ordered the rig and prepared unusual specifications to meet their problem of on inaccessible drilling site.

Among the rig's features: A drawworks which can be disassembled to 4,000-lb. weight packages; three light, portable triplex plunger mud pumps; rubberized fabric tanks for fuel and water storage and aluminum tanks with rubberized fabric liners for mud storage; eleven engines for generating AC and DC current.

Total weight is under 400,000 lb., or half that of a comparable conventional rig. No rig efficiency, the suppliers claim, is sacrificed. The cost: About $1.25 million.

▼ ▼ ▼

Six independents have a new approach to the squeeze of high costs and limited opportunities.

They're teaming up to pool their money and talent in bigger game where the risks are greater but so are the stakes. Their first objective is the deep and promising Miocene area of southern Louisiana (p. 102).

Paradox basin activity grows.

Pure Oil Co. reportedly plans four new locations in the Northwest Lisbon area of San Juan County, Utah. There are six wells going in the general area of the state's first Devonian producer—1 Northwest Lisbon.

Busiest corner of the Rockies is Northeastern Wyoming.

Accelerated activity in Crook and Campbell Counties is expected to be the pacesetter in this province. Last year about 19% of the state's exploration was in this area.

▼ ▼ ▼

Production men will be interested in plans of Atlantic Refining for miscible flood of a Wolfcamp reservoir in a

13,000-acre Block 9 field of Andrews County, Texas.

Operators will pump up the Wolfcamp for 2 years with 2,250,000 bbl. of propane, 10 billion cubic feet of gas, and 2,000,000 bbl. of water before pressure becomes high enough to maintain miscible drive. Recovery is expected to increase from 17% of original oil in place to 89% (p. 100).

Opposition is fading to allowables for water floods.

Hearing will be held in Austin June 16 on plan to apply allowable ceilings to Texas stripper floods. Substantial number of operators who formerly fought all restrictions on such floods reportedly will not oppose the idea.

Prospects are that a large group of operators will propose a flexible method of limitation which would set a ceiling for a project but would let the operator produce that amount any way he wishes.

Informed sources say the exact mechanics of such a plan have not yet been worked out. The method is certain to be much milder than those expected from other major operators.

▼ ▼ ▼

Automation is paying off for the pipeline industry, but it is also causing some big headaches in personnel displacement and training.

The joys and woes of automation have been reviewed by a blue-ribbon panel of executives and engineers (p. 114).

Pay of key craftsmen on a pipeline—the welders—will reach a top of $4.40 an hour this year.

Pipe Line Contractors Association and union agents have agreed to rates of $4 per hour in Arizona and $4.40 in New Jersey and California. Another 15 cents an hour will be added on May 1, 1961.

Two 30-in. pipelines are planned from Libyan discoveries 100 miles to the Mediterranean.

Both Jersey Standard and Oasis have reserves to justify the large diameter. The Oasis line will have more than 200,000 bbl. daily capacity with gravity flow due to the slope from the field to the sea.

▼ ▼ ▼

Humble is still undecided on a gasoline brand name for use in service stations soon to be established in Ohio.

Several possible names are under consideration and the one selected may eventually be used nationwide.

A universal oil credit card will be in circulation by January 1. Three majors have agreed to participate. Seven other majors are still studying the proposal. Four regional marketing firms have agreed to participate (p. 108).

Market Memo

May 9, 1960

Current demand for gasoline is up—the sun is out and so are people, on tractors and in cars.

The spot gasoline prices, however, are low—refiner's morale is shaken. It means crude prices are wobbly too.

And why not? Dig these bitter price pills that some refiners are swallowing:

Gasoline in Group 3 for northern shipment is trying to find bottom. Spots are one-fourth off new 10.50-cent price. Inter-refinery purchases of 91-RON material can be made at 10 cents per gallon...Chicago 91-92 RON is also down to 11.00 and 11.125 cents...Mississippi River prices are the low Gulf Coast to one-half cent off low for barge lifting with little buyer interest...Gulf Coast is stagnant at one-half to three-quarters cent off posted for prompt lifting. The Gulf Coast-East Coast gasoline inventory relationship portends a better price climate as summer demand develops.

Middle distillates from Group 3 are finding weak demand. Their status is so depressed prices may go down before they go up. Discounts of one-half cent or more are available...The Mississippi River markets also are listless at one-quarter to one-half cent off Gulf Coast lows. Refiners are taking the position they can save money by not selling at this time... East Coast summer discounts on middle distillates are building spring interest in Gulf Coast No. 2. Sellers are holding the line at three eighths to one-half cent off posted price as winter contract talks are under way.

No. 6 fuel oil is the one Gulf Coast product firm at the posted $2.10 price. Low sulfur No. 6 is tight at $2.45. Demand for bunkering has first call on No. 6 from Gulf Coast refiners...Estrangement between Gulf Coast No. 6 supply and East Coast No. 6 demand is permanent. The East Coast No. 6 price is now a government welfare project and gives import quota fuel the most charm.

General market concerns now: Excess crude runs to stills, excess gasoline production, and excess gasoline inventories.

Midwest spot product prices are exerting tremendous pressure on posted crude prices...Computers tell Oklahoma refiners that current prices for products and crude are 30 cents a barrel out of balance...Gulf Coast computers call for crude runs through May of 7,400,000 bbl. daily and 7,800,000 for June. This would give gasoline supply time to balance out with projected gasoline demand.

For spot prices, see page 269.

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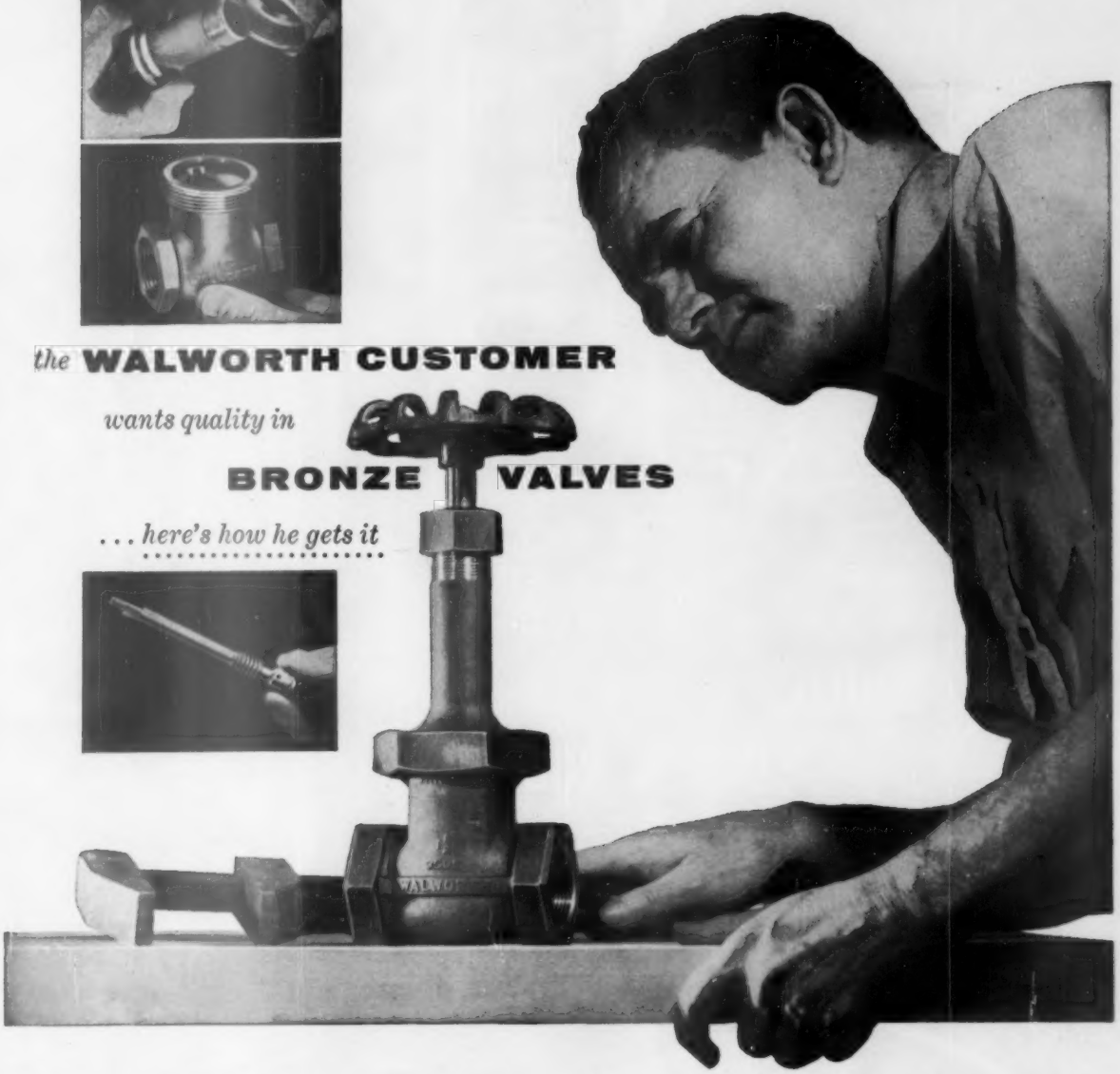

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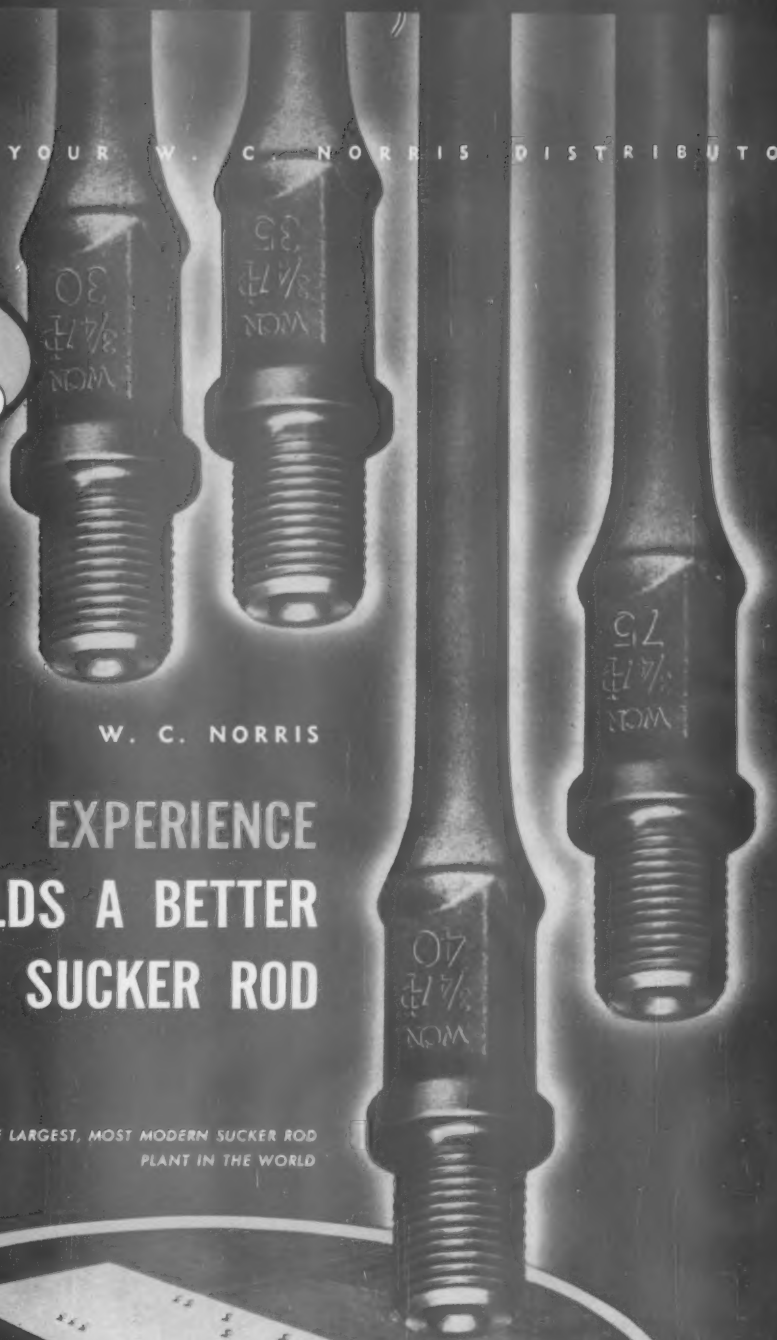

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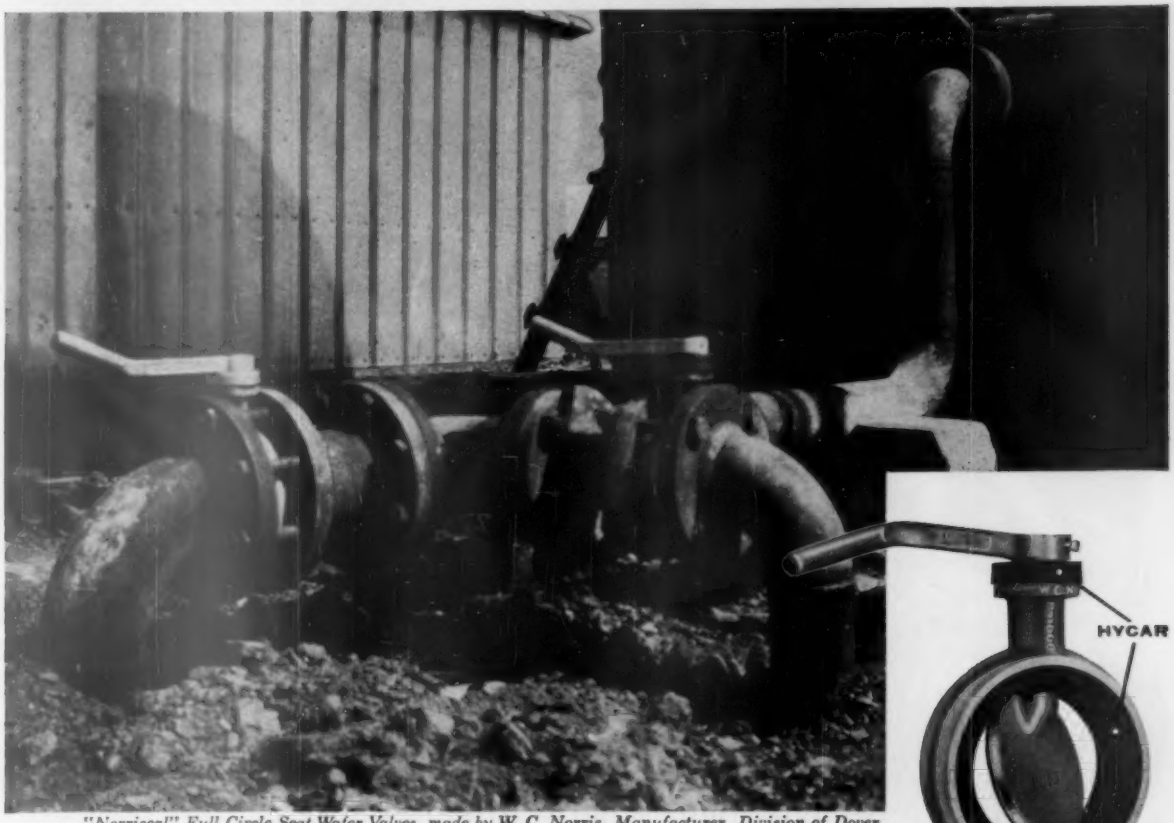

"Norriseal" Full Circle Seat Wafer Valves, made by W. C. Norris, Manufacturer, Division of Dover Corporation, Tulsa, Oklahoma, are available with seats and dust covers made of Hycar by Murray Rubber Company, Houston, Texas. B.F.Goodrich Chemical Company supplies the Hycar nitrile rubber.

Oil field problems solved with valve seats and seals of Hycar

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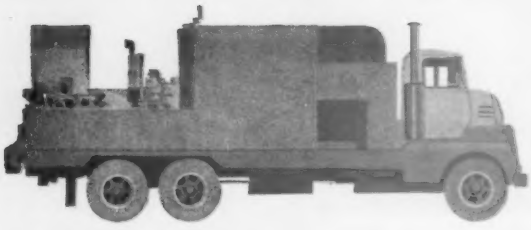

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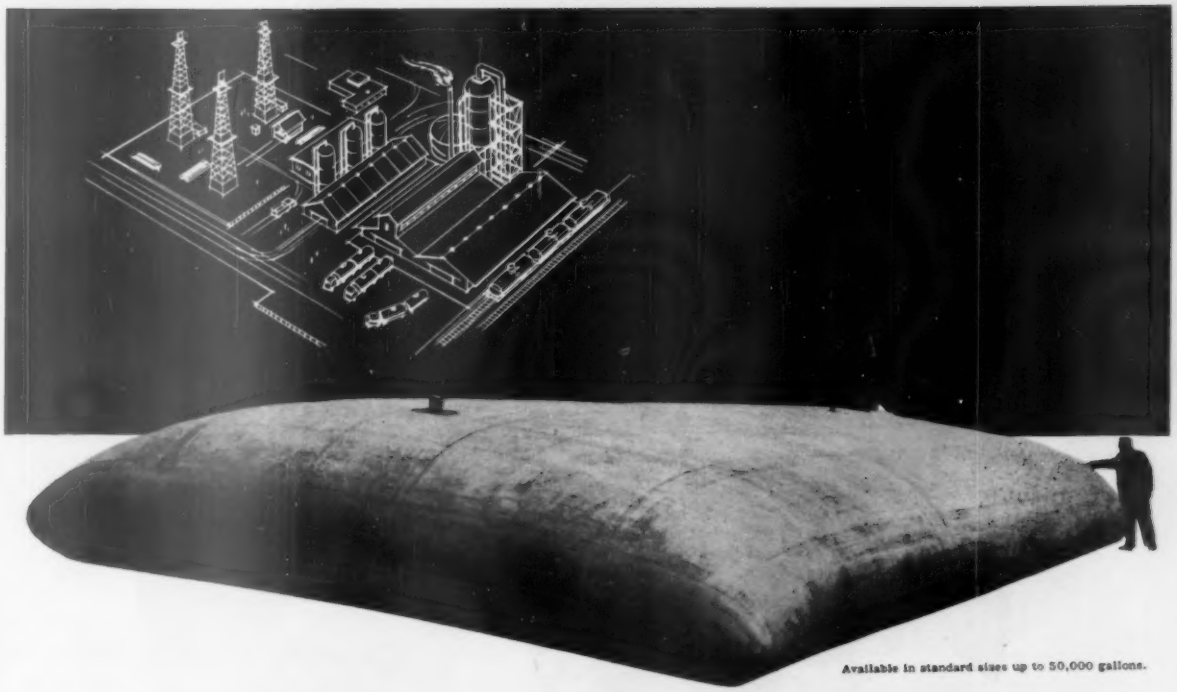

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10,000 gals. (rectangular)	148" x 20" x 16"
15,000 gals.	180" x 20" x 20"
20,000 gals.	180" x 20" x 20"
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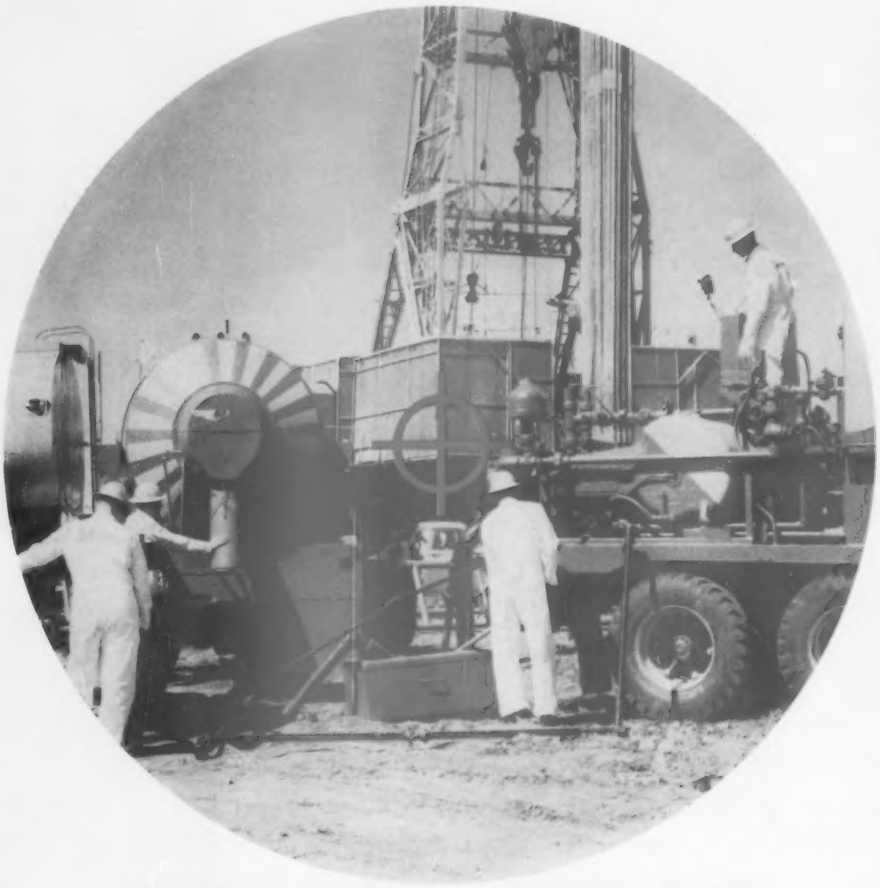

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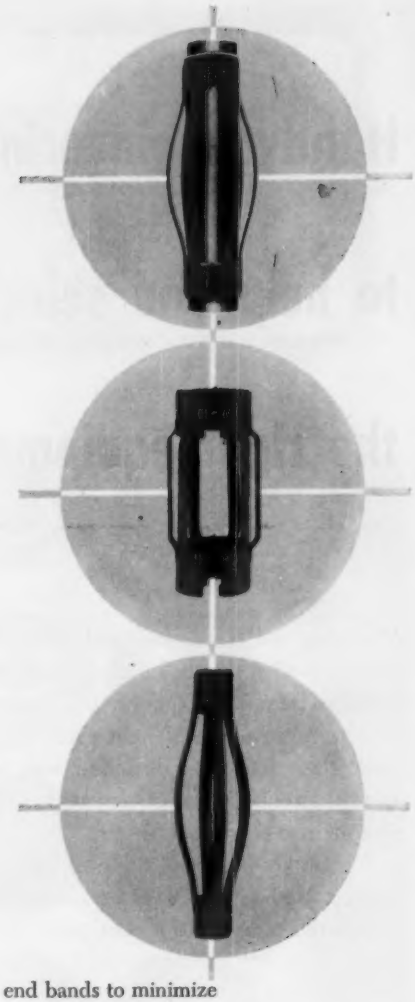

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- Special Heat Treated Steel Springs help prevent loss of bowed height to retain maximum centering force for pipe after trip to bottom.
- Hinged Type saves rig time – no welding required when hinged over collars.
- Lap Welded Construction of springs to end bands minimizes spring breakage often occurring from butt-welding.
- Good Annular Circulation since adequate spacing of springs minimizes obstruction to flow of fluid.

EZ LOK LIMIT CLAMP

... new method of installing auxiliary equipment on casing or tubing without welding. Hinged for easy installation.

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to help you select

the right equipment

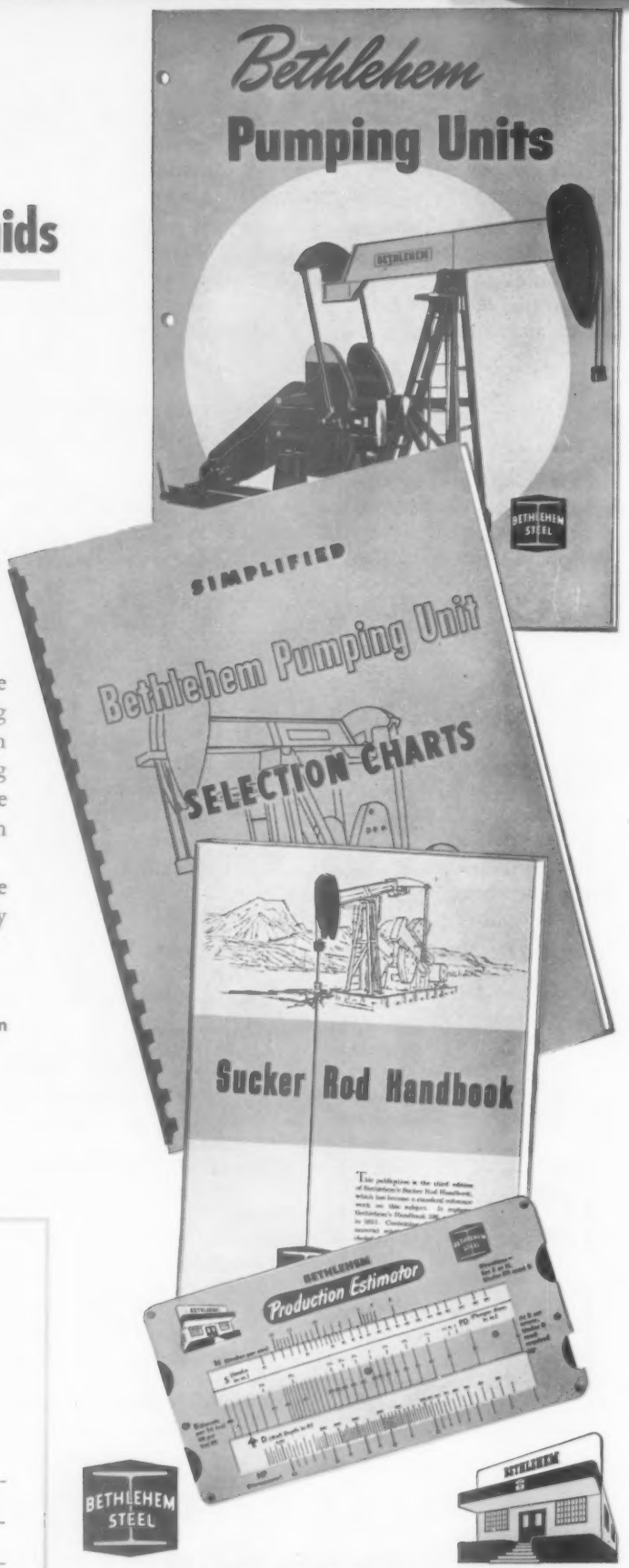
Pumping units, sucker rod strings, prime movers—all major equipment for a producing well can be selected quickly and correctly with one or more of Bethlehem's free engineering aids. Each has been designed with the same careful attention to accuracy as the Bethlehem production equipment itself.

To obtain your aids, phone or write the nearest Bethlehem office or store—or simply attach the coupon to a post card.

BETHLEHEM STEEL COMPANY, Supply Division

General Offices and Export Dept.
21 East Second St., Tulsa, Okla.

Canadian Distributor:
Bethlehem Supply Company of Canada, Ltd.
Calgary, Alberta, Canada



TO: BETHLEHEM STEEL COMPANY, SUPPLY DIVISION
SALES DEPARTMENT OGJ, BOX 2171, TULSA 2, OKLAHOMA

Please send me:

- ☐ Booklet 1646, Bethlehem Pumping Units
- ☐ Booklet F, Simplified Selection Charts
- ☐ Handbook 489, Sucker Rod Handbook
- ☐ Calculator 1621, Bethlehem Production Estimator

NAME:_____

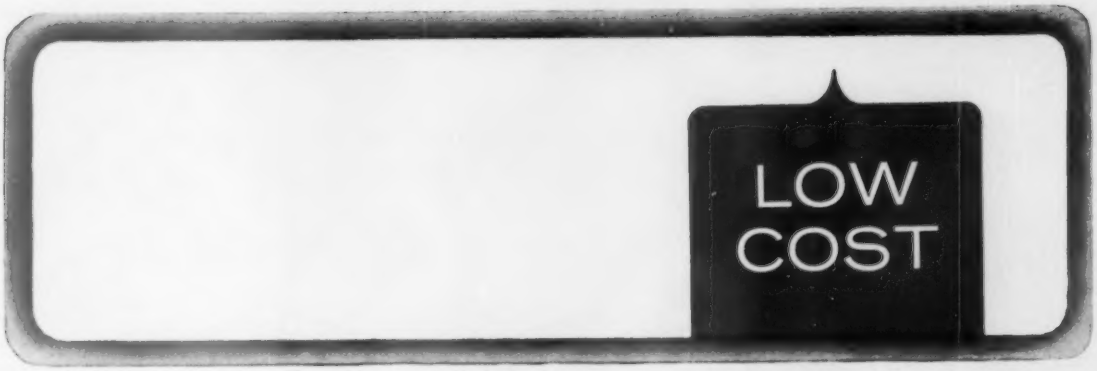
TITLE:_____

COMPANY:_____

ADDRESS:_____

CITY & STATE:_____

BETHLEHEM STEEL
SUPPLY DIVISION



HYDROCARBON RECOVERY

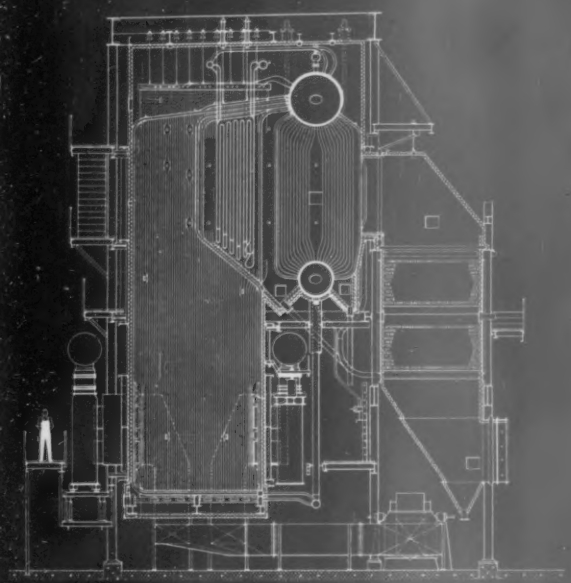
with efficient, economical Davison Silica Gel

Hydrocarbon recovery from the dehydration of natural gas can pay your gas drying costs. The large pore volume of Davison Silica Gel attains recovery efficiencies up to 95%. For example, a unit operating on 30 to 120 minute cycles at 100° F. can recover up to three gallons of butane-plus per 100 lbs. of silica gel.

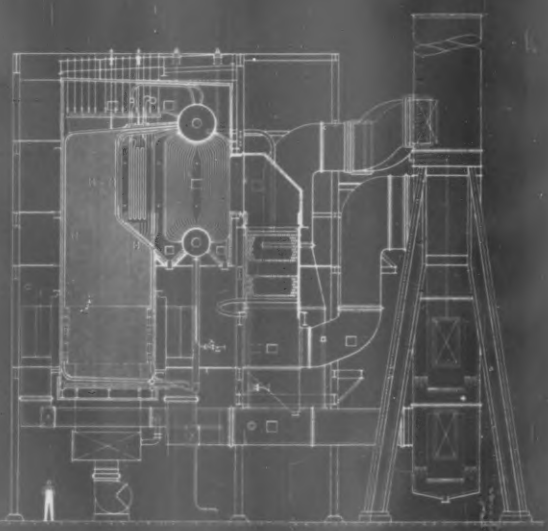
Specify Davison Silica Gel in your hydrocarbon recovery unit. Write Dept. 3105 for complete information.

Department 3105
W.R. GRACE & CO.
DAVISON CHEMICAL DIVISION
BALTIMORE 3, MARYLAND

This unit delivers 175,000 lb of 750F steam per hour at 650 psig. In addition to CO gas, it burns pitch, refinery gas and Bunker C oil.



One of two CO boilers for a Texas refinery. Oxygen for combustion is supplied by the exhaust from the gas turbines which drive the regenerator compressors. Steam conditions are 177,000 lb per hr, 625 psig and 700F.



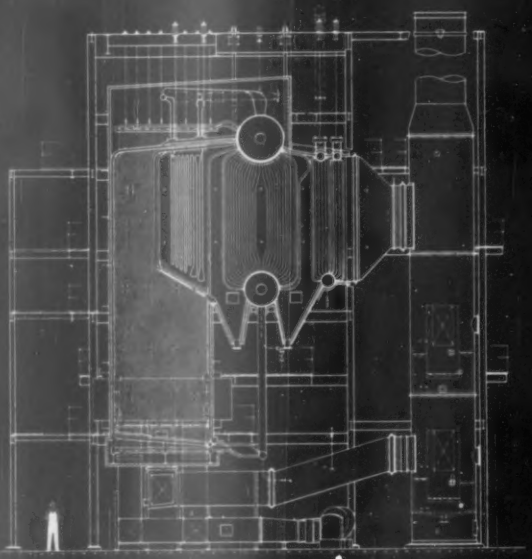
If you're looking for the best catalyst regenerator gas

Here are 8 reasons why

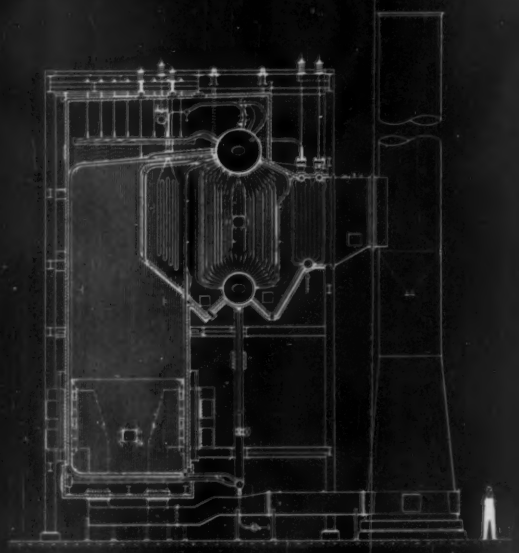
1. **YOU'LL WANT HIGH AVAILABILITY**
   And the records show that the first CO Boiler placed in service by C-E has been on the line for more than two years without a single unscheduled boiler outage.
2. **YOU'LL WANT OPTIMUM RETURN**
   And CO Boilers by C-E burn regenerator gas efficiently *from minimum to maximum loads.*
3. **YOU'LL WANT LOW POWER CONSUMPTION**
   And CO Boilers by C-E provide minimum air pressure loss and minimum fan horsepower requirements.
4. **YOU'LL WANT LOW MAINTENANCE**
   And double steel, skin cased CO Boilers by C-E contain a minimum of exposed refractory.
5. **YOU'LL WANT THE MOST EFFECTIVE USE OF MATERIALS**
   And C-E makes optimum use of boiler and superheater – gas passage areas and heating surfaces are uniformly distributed across the width of the unit.
6. **YOU'LL WANT ADVANCED DESIGN**
   And C-E Tangential Burners provide complete and positive mixing of air, auxiliary fuel and CO gas, preparing the combination for instantaneous ignition on injection in the furnace.
7. **YOU'LL WANT MAXIMUM CONTROL OF THE COMBUSTION PROCESS**
   And CO Boilers by C-E offer individual, shielded cut-off dampers for each CO gas burner and individual air control for every burner.
8. **YOU'LL WANT A PRODUCT THAT HAS PROVEN ITSELF**
   In terms of general experience, a total of more than 675 tangentially fired C-E boilers have been purchased to date for use with various fuels. As to specific experience with lean fuels, C-E – in addition to its CO Boiler installations in refineries – has installed more than 150 boilers burning blast furnace gas . . . a fuel similar to CO gas with a heating value of about 80 Btu per cubic foot.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS;

This unit is designed to produce 85,000 lb of 750F steam per hour at 625 psig. Note the C-E seal tank arrangement in the bottom-supported stack.

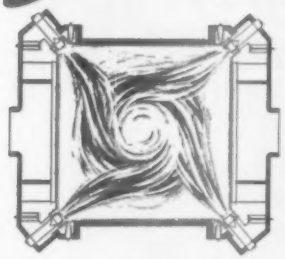


In its third year of service, this unit provides 100,000 lb of 550F steam per hour at a pressure of 250 psig. It has been off the line only when the cat cracker was removed from service for scheduled maintenance.



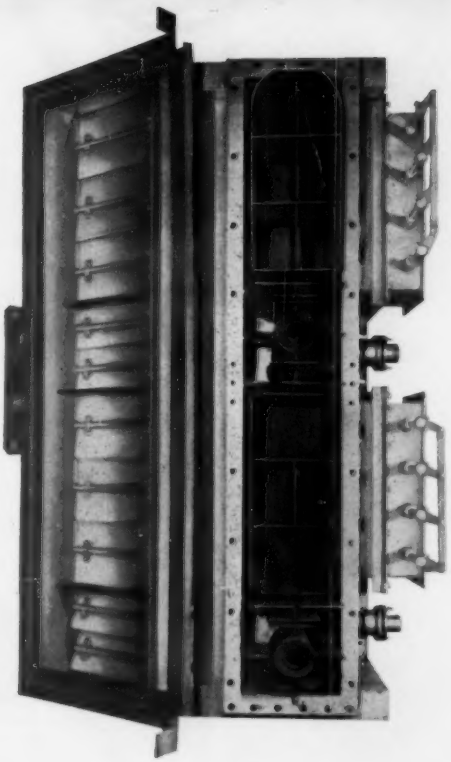
boiler to burn

See C-E



Plan view diagram showing principle of tangential firing in a completely water-cooled furnace.

The C-E Tangential Burner for CO gas. Zone controlled, dampered air inlets are shown at left, dampered CO gas inlets at right. The center panel is a furnace view of the burner The oil burners in the cen ter and bottom compartments are flanked by flat head burners for natural or refinery gas firing. CO gas is admitted through the other ports.



COMBUSTION ENGINEERING

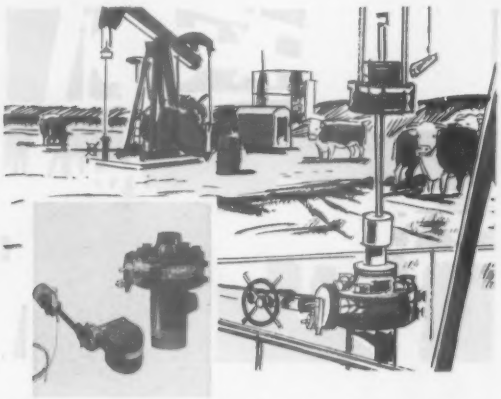
C-148

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

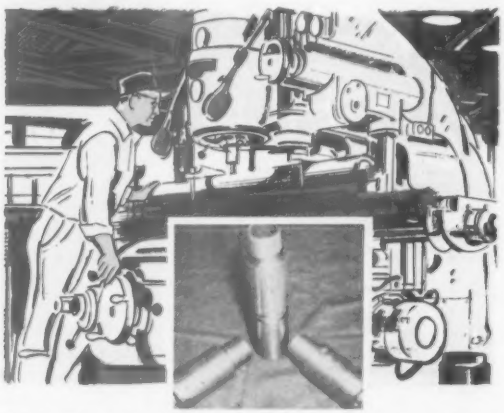
PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

ANOTHER CASE OF
HOMCO MANUFACTURING
VERSATILITY

"Only experience guarantees quality in manufacturing... and HOMCO has it!"



Homco Ace-O-Matic Rod and Tubing Revolvers are effective, economical methods of extending the life of rods and tubing on pumping wells. Compact (body diameter: 5-ins. OD) Homco Ace-O-Matic Revolvers fit most carrier bars. Rod revolver is easily installed at any time. Tubing revolver may be installed before tubing is in place or when tubing is pulled for well workover. In addition to giving extra life to the polish rod, rod revolver helps control paraffin. For added safety, tubing revolver has all the necessary pressure control features of a tubing hanger.



Homco Tubing Tool Joints convert tubing to workover strings and protect the tubing string against crushing action of tongs. Designed for fast make-up and break-out, Homco Tubing Tool Joints take all the wear and eliminate the danger of galling regular tubing threads. Machined from heat-treated S.A.E. 4140 steel, Homco Tool Joints are shipped in skidded steel cases to prevent damage. Joints are available as tool joint or coupling type.

IF YOU'RE LOOKING FOR EXPERIENCE
IN QUALITY MANUFACTURED PRODUCTS...
HOMCO HAS IT!

These proven products from the oil industry's most complete manufacturing and service organization guarantee you top quality tool performance.

Rod and Tubing Revolvers
Tubing Tool Joints
Type "E" Packers
Jet Bypass Valves
Precision Built Steel Subs

Homco Type "E" Packers are ideally suited for high pressure, high temperature completions. Constructed of heat-treated S.A.E. 4142 steel, these packers can be set with a considerable amount of weight which assures that packer will not become dislodged due to high pressure differentials and further insures that a positive seal is maintained. Incorporated in the packer is an automatic bottom which requires 7 to 8 turns to disengage, but may be re-engaged by simply raising the tubing string. This feature means that packer cannot disengage while going in the hole and cause premature setting.

Homco Precision Built Steel Subs are manufactured of high grade, heat-treated alloy steel. Homco Subs are manufactured, machine finished, accurately threaded and gauged to individual requirements to give you the highest quality drilling equipment you can buy. Homco Subs have uniform strength and rigid ruggedness, and are magnaflux inspected to assure that all materials meet Homco's high quality standards. These tools are available as Reducing Subs, Drill Collar Subs, and Drain Subs.

Homco Jet Bypass Valves are used with jet type drill bits to provide auxiliary openings in the drilling assembly above the bit. The valve permits normal fill of pipe while running in the hole thereby reducing the possibility of damage to lost circulation zones because of pressure surges. Valve remains in closed position when circulating and directs all the drilling fluid through the bit. When drilling assembly is retrieved, valve is in open position permitting pipe to drain, thus the swabbing effect of the bit is reduced as it is retracted, and the necessity of pulling wet strings of pipe is eliminated.

WHATEVER YOUR DRILLING EQUIPMENT NEEDS, CALL HOMCO FIRST! Homco's experienced personnel have at their disposal all the required facilities to research and manufacture quality products that more than meet the oil industry's most exacting demands. For further information pertaining to any Homco product, contact your local Homco Supply Store.

HOMCO ALSO OFFERS

HOMCO

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"I can rent a car faster...any time, anywhere, with my HERTZ AUTO-matic Charge Card!"

Hertz rents spanking new, sparkling clean Chevrolets and other fine cars

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Get free HERTZ AUTO-matic Charge Card service (it's the charge card service *most* companies use) for your company—or yourself. Simply fill out the handy self-mailer at right. (With Hertz there's no application fee.)

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Send in your application for a free HERTZ AUTO-matic Charge Card today!

A HERTZ AUTO-matic Charge Card makes renting a car even easier!

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Just fill out this self-mailing application blank, drop it in the mail box—and your Charge Card is on its way!

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PERSONAL APPLICATION
HERTZ AUTO-matic Charge Card

OG

Check this box if you want HERTZ AUTO-matic Charge Card service for your Company

Applicant's Full Name — Residence Telephone No. — Married ☐ Single ☐ Other

Residence Number & Street — Years residing at this address — Own Home ☐ Rent Home ☐ Other

City, Zone & State — Age — Ht. — Wt. — Eyes Color — Color Hair

Employer or Firm Name — Business Telephone No. — Type of Business

Business Address Number & Street — Position — Yrs. in Position — Yrs. with this company

City, Zone & State — Annual Income: Under $5,000 ☐ Over $5,000 ☐ Over $10,000 ☐

Checking Account Reference Bank Name — Account Number

Branch or Street Address — City — State or Province

National Credit Card—Co. — # — Expires

National Credit Card—Co. — # — Expires

Driver's License—State — # — Expires

Present HERTZ Card No. — Enclosed ☐ Lost ☐ None ☐

Please issue HERTZ AUTO-matic Charge Cards to me and those named at right for which I assume full responsibility.

Signature _____ Date _____

MAIL CARD and BILLS TO

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Issue additional cards for the following individuals with all charges to be billed to my account.

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Send in your application for a free HERTZ AUTO-matic Charge Card today!

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A HERTZ AUTO-matic Charge Card makes renting a car even easier!

NO POSTAGE REQUIRED!

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HERTZ puts you in the driver's seat!

HUSKY SECURITY H9* INCREASES BIT FOOTAGE...

SPEEDS DRILLING...CUTS COSTS...INVESTIGATE!

Write Dept. OGJ FOR H9 DATA SHEET AND COMPLETELY NEW 1960-1961 ALL-PRODUCTS CATALOG

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ROCK BITS
REAMERS • HOLE OPENERS
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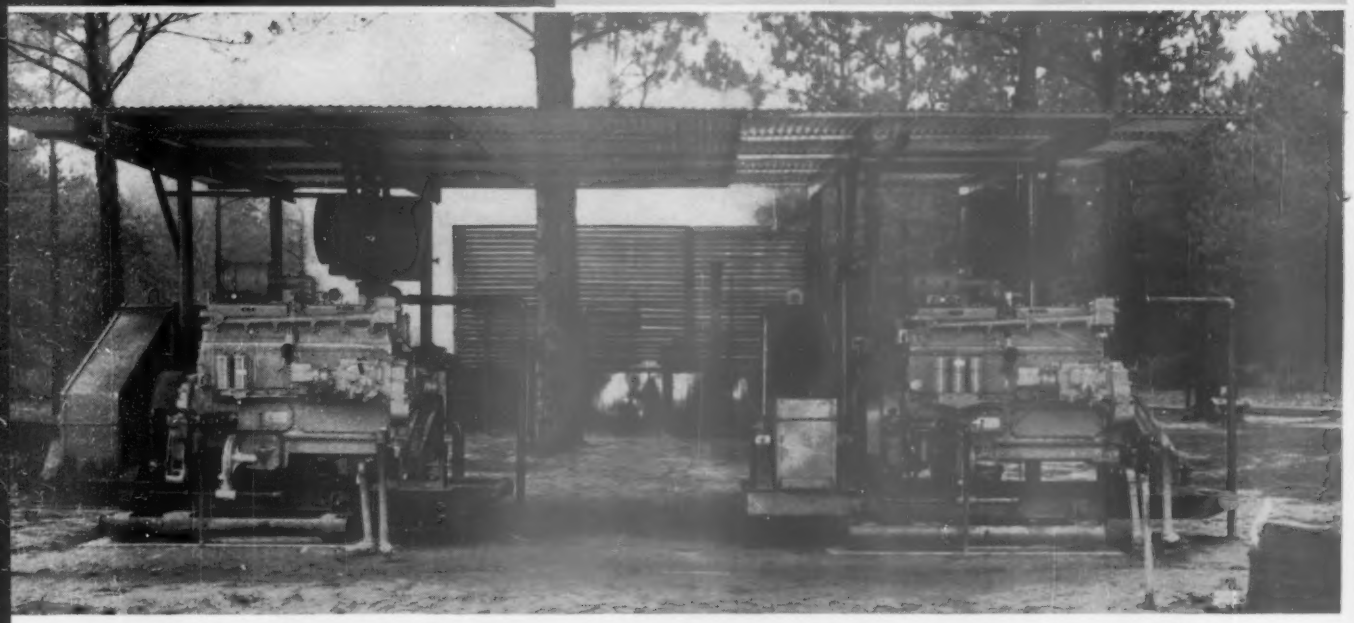
engine power
BY CATERPILLAR

CAT G342–WORLD'S LOWEST COST GAS COMPRESSOR ENGINE



Two Cat G342 Natural Gas Engines power Worthington Compressors, picking up low pressure flare gas from treaters and separators for delivery into United Gas Pipeline Co.'s sale line. Greenwood Gas Gathering Co., Shreveport, La., is the owner. Cat Natural Gas Engines need no derating.

BUY IT—RUN IT—MAINTAIN IT—FOR LESS

Buy a gas compressor engine on price—and *only* price—and you narrow the field to the Caterpillar G342. Buy on what's in the engine and what the engine does—and again the field narrows to Caterpillar.

Like all Cat Natural Gas Engines, the G342 is a diesel at heart, built on a basic diesel block, using standard diesel engine parts everywhere possible. Only pistons and fuel systems are changed for natural gas operation. You can operate the G342 and all Cat Natural Gas Engines continuously at full horsepower *without derating*. This is true only of Cat Natural Gas Engines. But then no other company builds natural gas engines like Caterpillar.

Caterpillar insists soft metals have no place in crankshaft journals. We induction harden ours and give them a "super-finish" which decreases wear between shaft and bearing metals. "Super-finishing" cuts friction. Cat cranks and journals are bound to outlast those of soft metals.

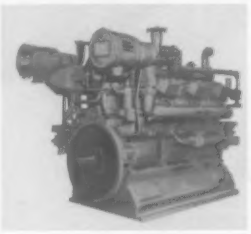
Take valves. We use alloys created for the high pressures and temperatures of diesels. They give exceptional service under the milder operating conditions of Gas Engines.

And which would you choose for bearings: steel backed aluminum alloy or a soft metal like babbitt or copper lead? There is no choice, we believe. In view of crankcase acids and the effects of friction, bearings have to be aluminum alloy, if the engine is going to deliver what you want it to.

The same reasoning applies to ring facings and cylinder liners. We use chrome on all rings and induction hardened, chemically treated liners. Hundreds of thousands of trouble free hours have proven Cat's ideal mating of these hardened parts fights scuffing and wear between rings and liners.

What about costs? The Cat G342 is the *world's lowest cost gas compressor engine.* Cat Natural Gas Engines have the *lowest fuel consumption per BHP of any engine in this horsepower range.* (Cat high compression gas engines will pay for themselves in fuel savings *alone* before the first major overhaul.) *Over-all operating costs of Cat 10.5:1 Natural Gas Engines are the lowest in their field.*

Insist on a Caterpillar Natural Gas Engine when ordering oilfield equipment. Your Caterpillar Dealer can tell you much more about the G342 . . . and about Cat Natural Gas Engines, in 7.5:1 or 10.5:1 compression ratios, naturally aspirated or turbocharged and aftercooled, up to 560 continuous HP. Visit him about the most unusual engine values available.



CATERPILLAR

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Engine Division, Caterpillar Tractor Co., Peoria, Ill., U.S.A.

ANOTHER WAY RCA SERVES BUSINESS THROUGH ELECTRONICS

It's what's inside RCA's Transistorized "LD" Radio that makes it your greatest value!

Take a look inside the new RCA 2-Way Radio and you'll see an array of advanced improvements that give you new economy, dependability and performance.

Sensibly designed with you in mind, the "LD"* employs standard transistors only in circuits where long experience proves their reliability . . . where they can do the best job of cutting down on costly battery drain. You get maximum profit-earning "on air" time, too, because circuits are "Road Map" coded for fast, sure servicing guidance.

You'll like the extra measure of dependability you get with Security Sealed Circuits assuring top performance under the most rugged operating conditions. And you'll cheer the "LD's" booming voice—thanks to a powerful five watts of audio.

Priced considerably lower than other transistorized 2-way radio equipment—comparable in cost to conventional tube-type radios—the "LD" is your greatest value.

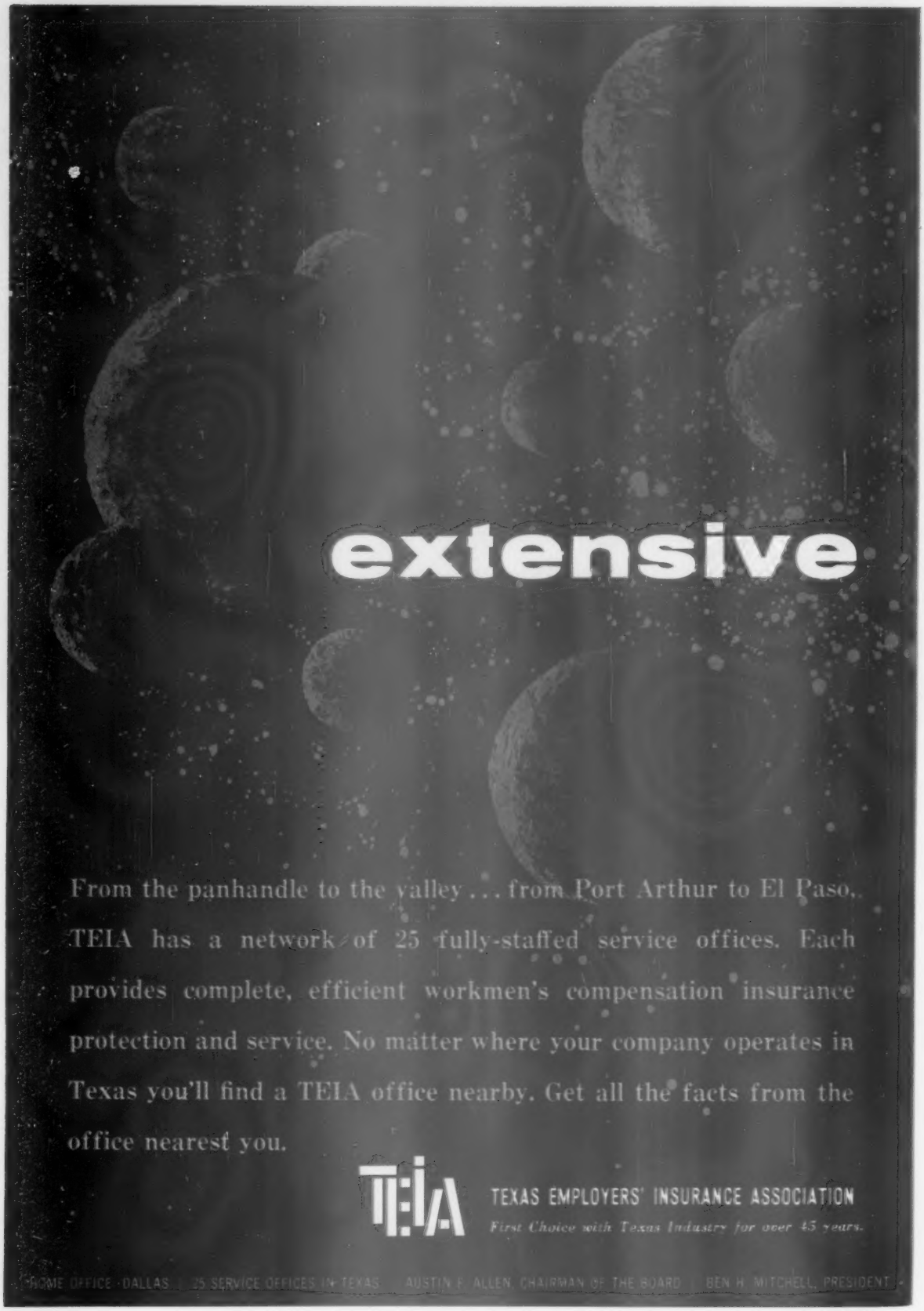
So if it's economy, dependability and performance you want in 2-way radio—if you are looking for a way to improve the efficiency of your operation—get the whole *RCA* story, right away.

Your RCA Representative will be glad to explain further why RCA "LD"
**(Low Drain) equipment is today's best buy in 2-Way Radio. Or for complete descriptive literature — write RCA, Dept. G-89, Bldg. 15-1, Camden, N.J.*

RCA Tmk(s) ®

RADIO CORPORATION of AMERICA

COMMUNICATIONS DIVISION • CAMDEN, N. J.


extensive
From the panhandle to the valley . . . from Port Arthur to El Paso, TEIA has a network of 25 fully-staffed service offices. Each provides complete, efficient workmen's compensation insurance protection and service. No matter where your company operates in Texas you'll find a TEIA office nearby. Get all the facts from the office nearest you.
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First Choice with Texas Industry for over 45 years.
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This "jeweled" escapement brings you fine watch quality in chart drives

See how easy it is to convert to seven different rotation rates

The main arbor on the basic chart drive has a rotation rate of seven days. Economical snap on turrets convert this rate to 8 day, 15 day, 16 day, 24 day, 30 day, 31 day and 24 hour rotation. No tools are required and you can even change chart rotation without removing the drive from the instrument.

Now, for the first time you get the extra value of a jeweled movement. This superior construction makes Rockwell chart drives more accurate and sensitive than ordinary chart drives. It requires less power to drive and is extremely durable since there are seven hard jeweled surfaces to overcome friction and wear.

You can use these jeweled movement chart drives *with profit* to power all your recording instruments. They will adapt into practically any instrument case. Speed changing turrets (see left) permit varying rotation rates at will. Write for bulletin. Rockwell Manufacturing Company, Dept. 59E, Pittsburgh 8, Pa. In Canada, Rockwell Manufacturing Company of Canada, Ltd., P.O. Box 420, Guelph, Ontario.

JEWELED CHART DRIVES

another fine product by

ROCKWELL

You save drilling dollars with

THE

MUD PROBLEM: To protect formation from filtrate water damage and alleviate the two conditions of out-of-gauge bits and enlarged hole.

WELL DATA

Location: Sublette County, Wyoming
Total Depth: 11,564′. Hole from 506′ to T.D. drilled with 7⅞″ bits
Bottom Hole Temperature: 137°

CASING PROGRAM

Size Inches O.D.	*Depth Set Feet*
13⅜″ casing	506

MUD ADDITIVE PROGRAM

0′ to 9,323′	AQUAGEL*, TANNEX*, caustic soda and HV DRISCOSE†.
9,323′	Converted to invert emulsion made up of 60% diesel fuel, 40% water, 20 ppb INVERMUL* and BAROID* to give mud weight of 10.0 ppg.
9,323′ to 11,564′	INVERMUL invert emulsion plus 13. ppb PETROTONE**.

TYPICAL MUD PROPERTIES

Depth, feet	9,000	9,323	10,130	11,564
Weight, ppg	10.0	10.0	10.0	10.4
Viscosity, cps	45	100	123	87
Stormer Gel, 10 min	2	8	2	2
Filtrate, cc API	6.0	0	0	0.3(oil)
Oil, % by volume		50	46	49
Water, % by volume		44	46	41
Solids, % by volume	6	6	8	10
Electrical Stability, volts		200	230	280

*Registered Trademark of Baroid Division National Lead Company
**Trademark of Baroid Division National Lead Company
†Registered Trademark of Drilling Specialties Company

DISCUSSION: INVERMUL mud was used to protect the Mesa Verde section from damage by water filtrate and to alleviate the two conditions of out-of-gauge bits and enlarged hole.

SOLUTION: Invert emulsion mud, made with INVERMUL, was selected not only because API filtration could be reduced to zero but also because of its high tolerance for contaminating water base mud that would become mixed with it during displacement. Additional INVERMUL mud can be easily mixed at the rig with rig equipment and the mud properties can be easily controlled or modified.
During displacement an estimated 400 bbl of water base mud remained in the sections of washed out hole and later became mixed with the INVERMUL mud causing some API filtration and settling of solids. API filtration was reduced to zero by adding 5% diesel oil and 5 ppb INVERMUL. Settling was eliminated by adding 1.3 ppb PETROTONE, a product specifically developed by Baroid for imparting suspending properties to invert emulsions and oil base muds. No out-of-gauge bits or worn out bit bearings were reported.

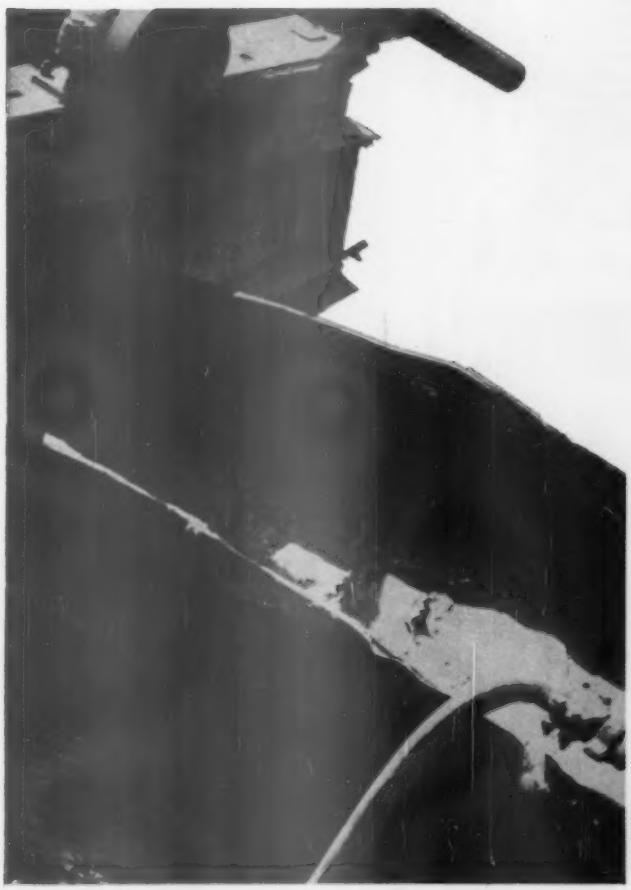
a Baroid Mud Program

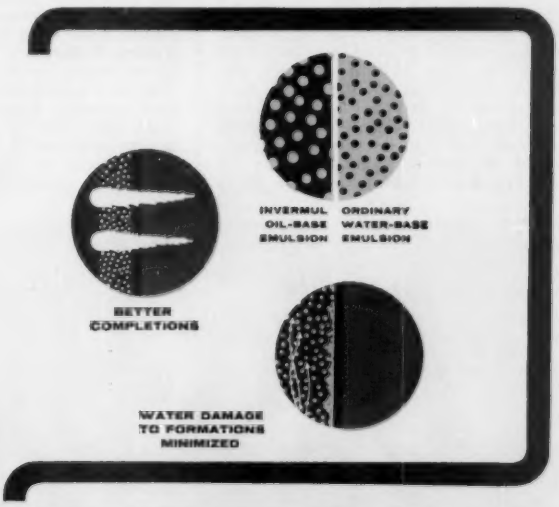
MUD PROBLEM

... and its solution

This case history demonstrates again how Baroid provides the right combination of mud products to solve drilling difficulties. In this instance the problems associated with drilling in a long section of open hole (11,058′) were: prevention of water filtrate to the formation, reduction of hole enlargement, and elimination of reaming due to out-of-gauge bits. These problems were solved by selecting INVERMUL oil base emulsion mud. The high tolerance of INVERMUL mud to contaminating water base mud proved to be a definite advantage. Approximately 400 bbl of water base mud from enlarged sections of the hole, became mixed with the INVERMUL mud. The resultant settling of solids and filtration increase were quickly corrected by adding INVERMUL, oil and PETROTONE.

Successes such as this are made possible by Baroid's integrated program that quickly brings specialized products and engineering skill to solve your mud problems.





BAROID

BAROID DIVISION NATIONAL LEAD COMPANY

MAIN OFFICE: P. O. BOX 1675, HOUSTON 1, TEXAS

6028

OTIS PRODUCTION NEWS

Volume I, Number 2 **Otis Engineering Corporation • Dallas** *Production Equipment and Services*

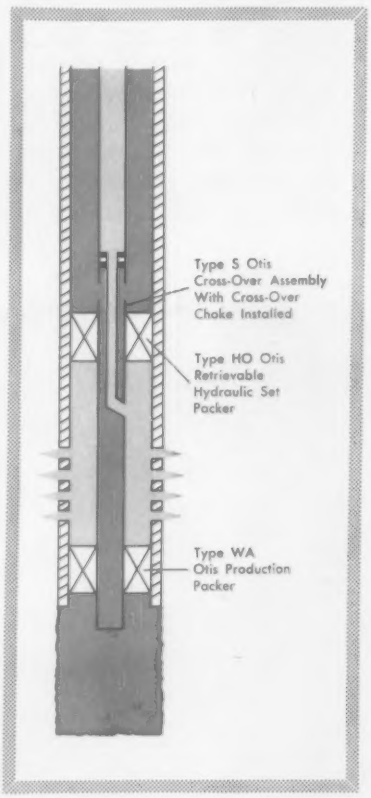
Otis 'Packaged' Well Completion Service Proves Solution To $80,000 Problem For Aggressive Oklahoma Operator

OKLAHOMA CITY — Otis well completion specialists from the Lindsay division have performed a slightly different, but basically sound, technique of completing a number of single string, dual producers for one of Oklahoma's most progressive independent operators. The wells are located in a new field being developed by this producer.The technique is that of snubbing all downhole production equipment into each well under pressure instead of killing the well. This technique has solved a problem which cost this operator some $80,000 on one well he drilled and completed in this field by another method.

The costly problem well potentialed 400 B.O.P.D. when originally swabbed in following a down-casing well stimulation treatment. Faced with not having production equipment in the well for either zone, and a 600 P.S.I. shut-in pressure, the operator decided to kill the well with a heavy lease oil before running packers and tubing. After necessary production equipment had been installed all attempts to swab the well in again failed, as did numerous special zone-stimulation fluids and treatments during the following 2½ months. When the well was finally brought in for the second time, its daily potential was considerably less than the initial 400 B.O.P.D. All told, the well owners counted a staggering $80,000 spent to get production back. Since that time Otis has been engineering the completions for this operator and snubbing all equipment into the hole under pressure. The cost of Otis' Snubbing Service has averaged less than $2,000 per well.

The completion equipment consists of a Type WA Otis Production Packer, a Type HO Otis Hydraulic-Set Packer, and a Type S Otis Cross-Over Assembly. The WA packer is a permanent-type, wire line set production packer which is used to isolate the two producing zones. The top packer is the Type HO Otis Hydraulic-Set Tubing Retrievable Packer, which is set by pressuring up on the tubing after first landing a special setting tool in the cross-over assembly made up in the packer.

In this type of installation the top packer is tested by bleeding off pressure in the casing. As engineered by Otis, this completion permits the lower zone to be produced through the annulus and the upper through the tubing — saving the cost of a second string of tubing and a dual packer — and at the same time affords a full-opening tubing string for obtaining bottom hole pressures, etc. The flow pattern of the two zones may be reversed if desired simply by changing chokes in the cross-over assembly.



Shown here are trained Otis service specialists rigging up to snub production equipment into a well under pressure. All equipment is hydraulically operated and well pressure is under control throughout the entire operation.

The technique of snubbing pipe and downhole production equipment in and out of oil and gas wells under pressure was developed by Otis 32 years ago. It has proved its economic advantages — as in the case of this operator — time and time again. The work is done by trained Otis specialists with unparalled experience in this type of work. For a detailed description of Otis' Snubbing Service, and the packers and cross-over equipment used in these wells — or for help with any of your well completion problems, call the Otis office nearest you or write Otis, Dept. 2-P, Box 35206, Dallas 35, Texas. Experienced Otis specialists are ready and anxious to provide you with a "packaged" well completion service.

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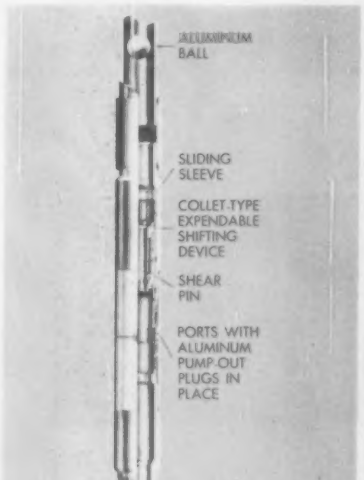
Better Production Tools Through Research

New Otis Tool Provides Additional Blowout Protection—Cuts Completion Costs

BELLE CHASSE — Operators in this area are using a new version of the Type A Otis Sliding Side-Door to complete their high pressure wells with greater safety and economy. This tool permits them to run high differential type drillable packers and nipple up the tree before unloading the well during completion operations. This makes possible a completion technique which allows the operator to keep his well under control throughout the entire operation. It also eliminates the need of having a wire line service unit on location and the problems encountered when performing wire line work in heavily weighted fluids.

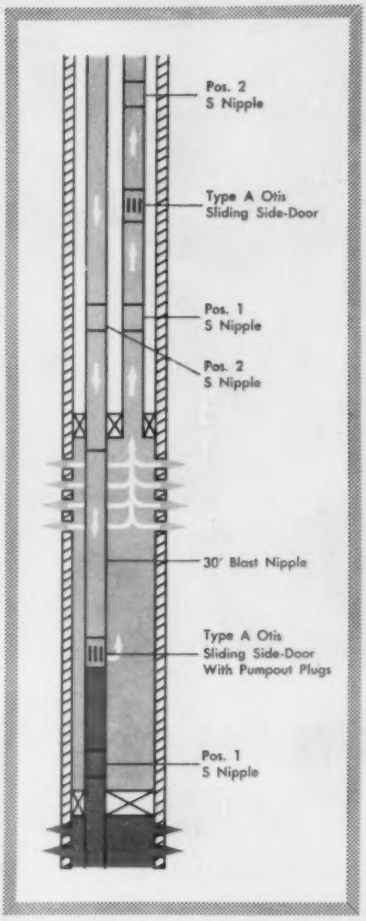
This new version of the Otis Sliding Side-Door is designed to be run into the well on the tubing with the sleeve opened. Tapered aluminum plugs inserted in the ports of the tool's outer mandrel serve to prevent communication from the casing annulus to the tubing until the well is to be circulated. A special collet type expendable shifting device is located in the upper recesses of the tool's sliding sleeve. This shifting device is designed to catch an aluminum ball or drop plug that is pumped down to close the side-door. (See illustration below.)



Type A Otis Sliding Side-Door with pump out plugs and expendable shifting tool in place.

The technique made possible through use of this new tool is both simple and sure. One of several ways the tool is being used is as shown in the accompanying schematic. The new model Sliding Side-Door, with special pump out plugs in the ports, is made up in the long string and located between the two packers. A standard Sliding Side-Door is located in the short string above the top packer for use at a later date. With this equipment in the well, packers may be tested by pressuring up on the short string. Blowout preventers are then removed and the tree installed with mud in the hole.

Once all provisions have been made to bring in the well, pressure is applied to the long string to dislodge the pump out plugs and mud is circulated out of the well through the short string. Approximately 400 pounds' differential pressure is all that is required to dislodge the plugs. Once mud has been displaced, the sleeve in the Sliding Side-Door may be shifted to its closed position by pumping down an aluminum ball or drop plug. The design of the expendable shifting mechanism in the Sliding Side-Door is such that when the sleeve reaches its fully closed position the collets on the expendable shifting tool release and the shifting device can be pumped out of the bottom of the tubing. After the Sliding Side-Door has been closed, it may be reopened for circulation or production at any future date by standard wire line methods. In the closed position, both V-type packing and O-rings act to provide a positive seal between the sleeve and outer mandrel of the tool.


Pos. 2 S Nipple
Type A Otis Sliding Side-Door
Pos. 1 S Nipple
Pos. 2 S Nipple
30° Blast Nipple
Type A Otis Sliding Side-Door With Pumpout Plugs
Pos. 1 S Nipple

The Otis Sliding Side-Door, with special pump out plugs, was designed and built to help operators reduce their costs when completing wells offshore and in inland water locations. However, the tool has proven so successful in this usage that several major companies have adopted both this new tool and completion technique as a standard operating procedure for all their high pressure wells.

Perhaps you are faced with completion and downhole production problems with which your local Otis specialists can help you. If so, call them today. For more information on the new Type A Otis Sliding Side-Door with pump out plugs or for help with any completion problem, call the Otis Office nearest you or write Otis, Dept. 2-P, Box 35206, Dallas 35, Texas. You'll find experienced Otis well completion specialists ready to help you — anxious to serve you.

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General Offices:

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New Otis Catalog Serves As Well Completion and Wire Line Service Guide

A new 116-page multicolored catalog of production equipment and services has just been published by Otis Engineering Corporation and is available upon request.

The new catalog contains drawings, operating diagrams, installation schematics, descriptive material, and complete dimensional data on more than a hundred different Otis tools — some of which have never been cataloged before. The catalog is divided into six sections to help the user find any piece of Otis equipment, or any one of their special services, easily and quickly. The sections cover Safety Equipment, Gas Lift Equipment, Completion Equipment, Post-Completion Equipment, Special Services, and Service Tools. Each section contains a concise preface describing the different types of equipment or services covered by that section and where and when the equipment or service should be used. The catalog has an index by sections, and is indexed and cross-indexed alphabetically by tool.

This new catalog will serve as the Otis section of the 24th (1960-61) Edition of The Composite Catalog, however those interested in obtaining a copy for their own personal use may do so by writing Otis Engineering Corporation, Dept. 2-P, Box 35026, Dallas 35, Texas.

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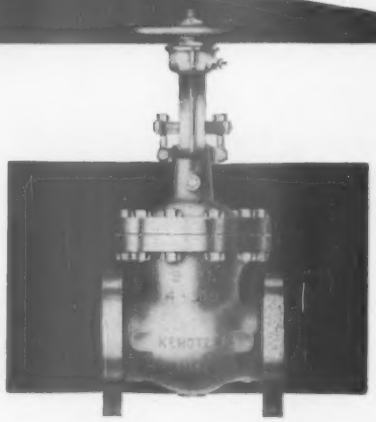

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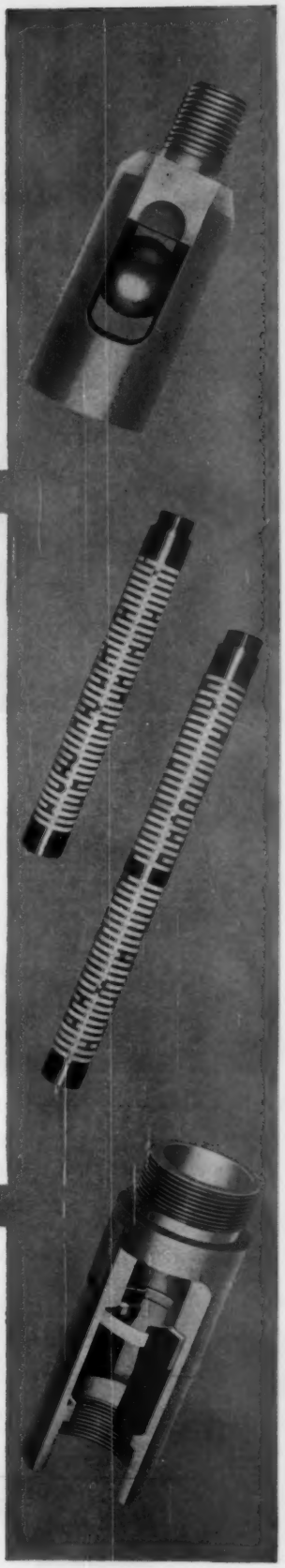

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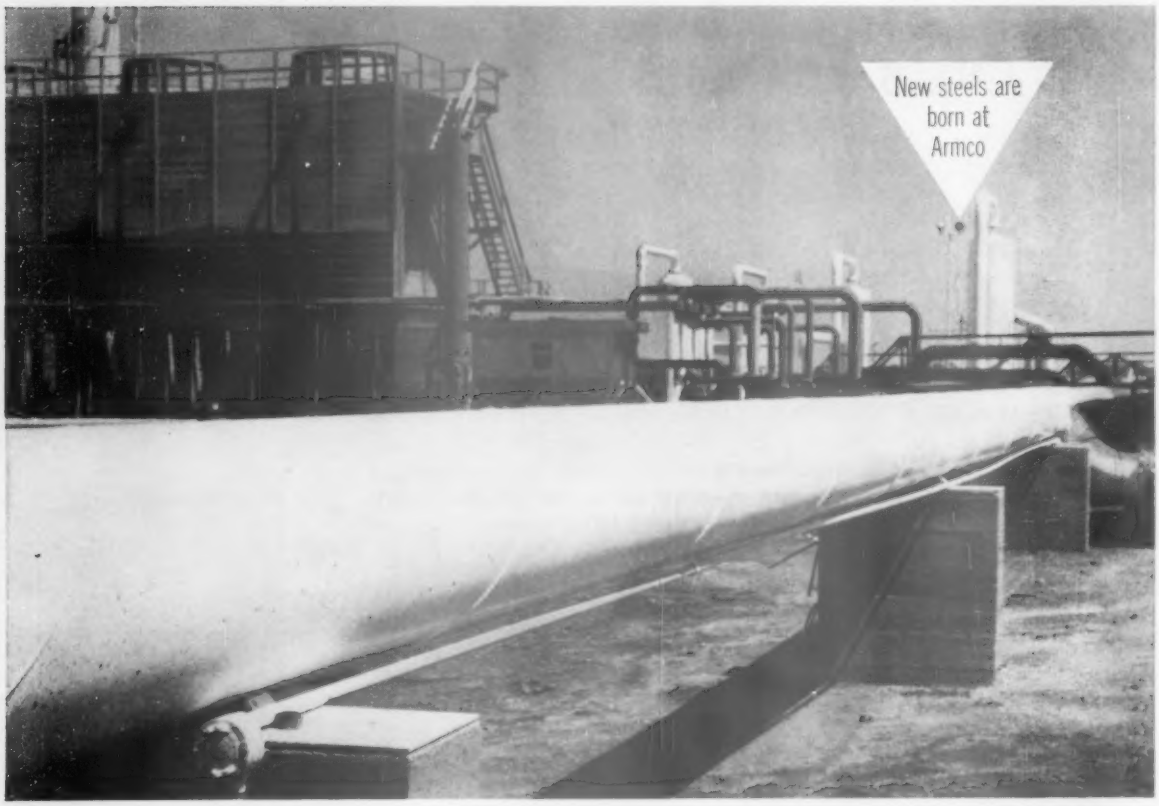

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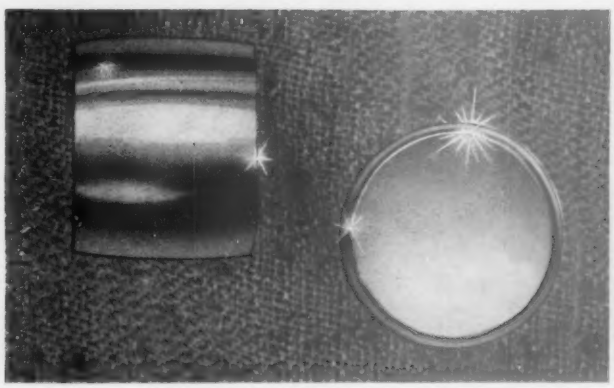

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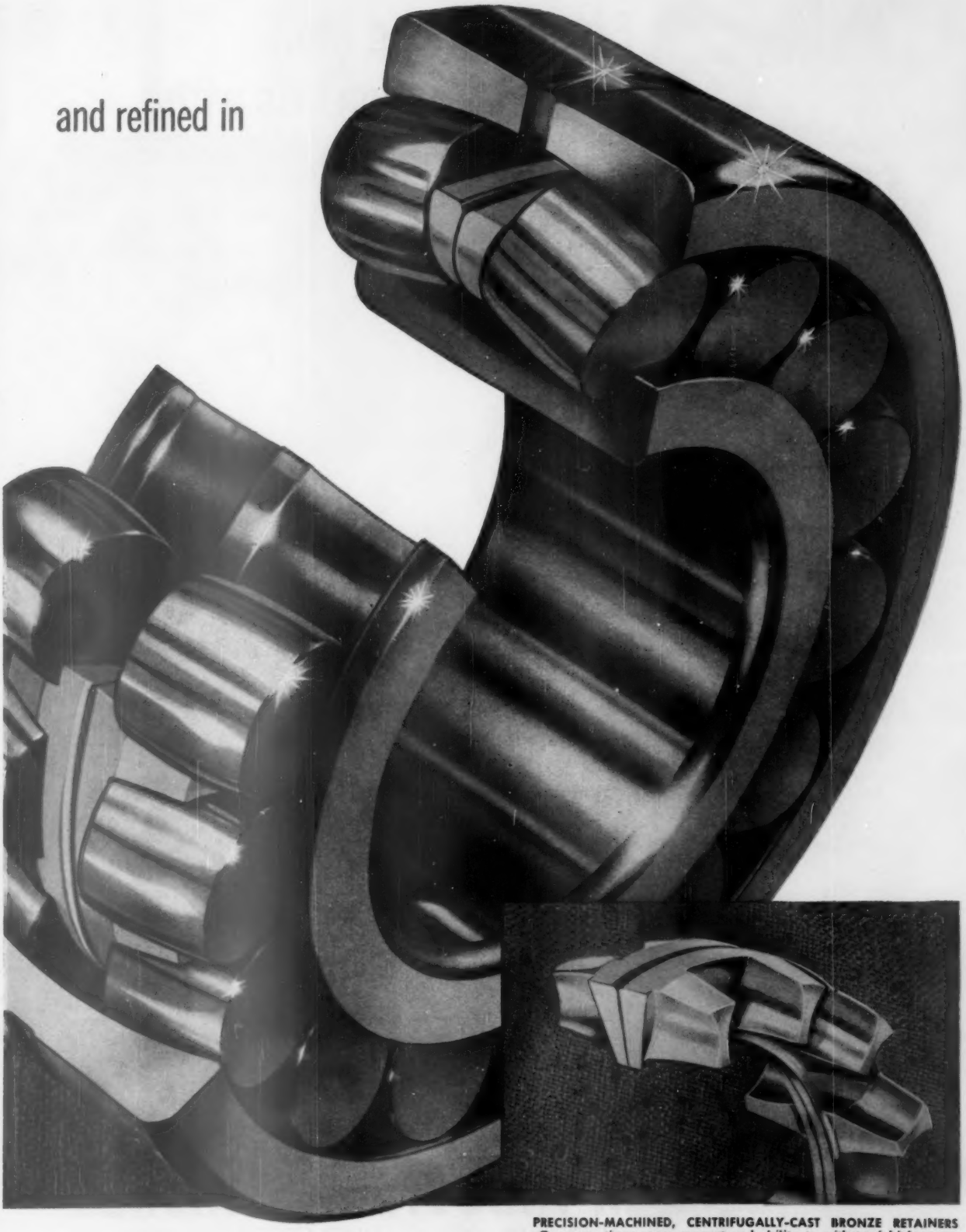

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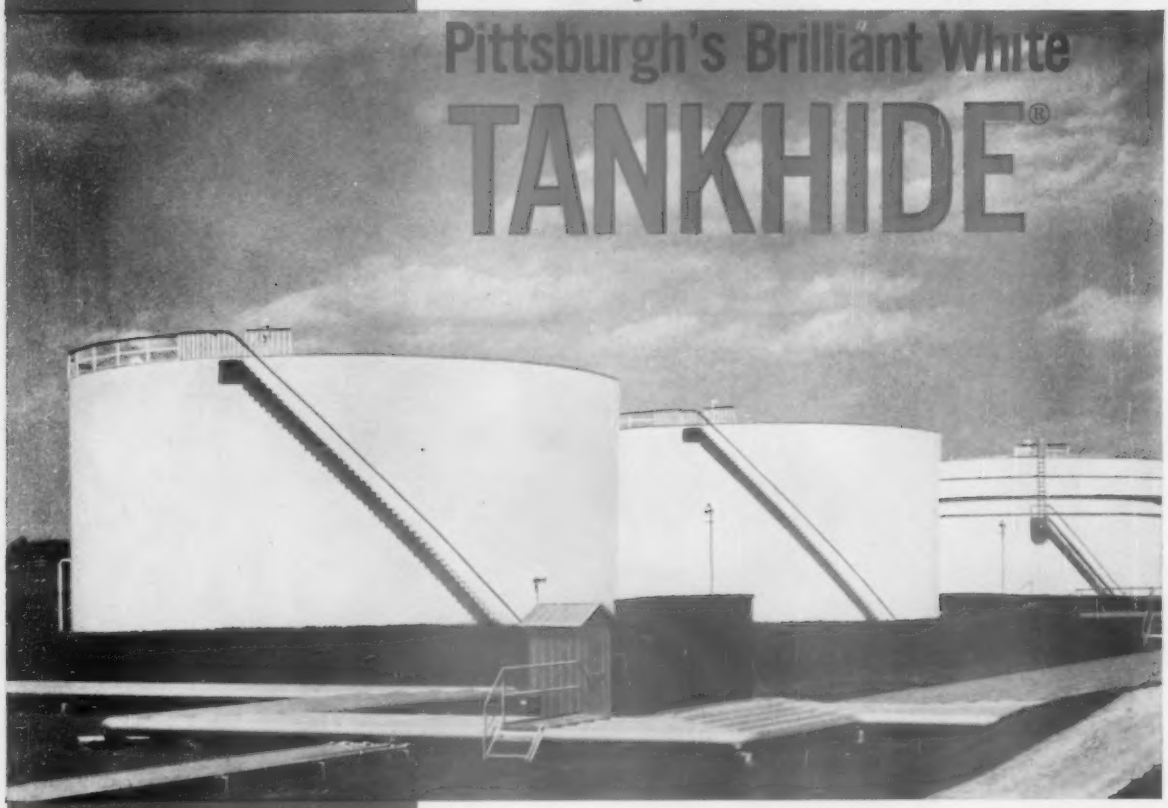

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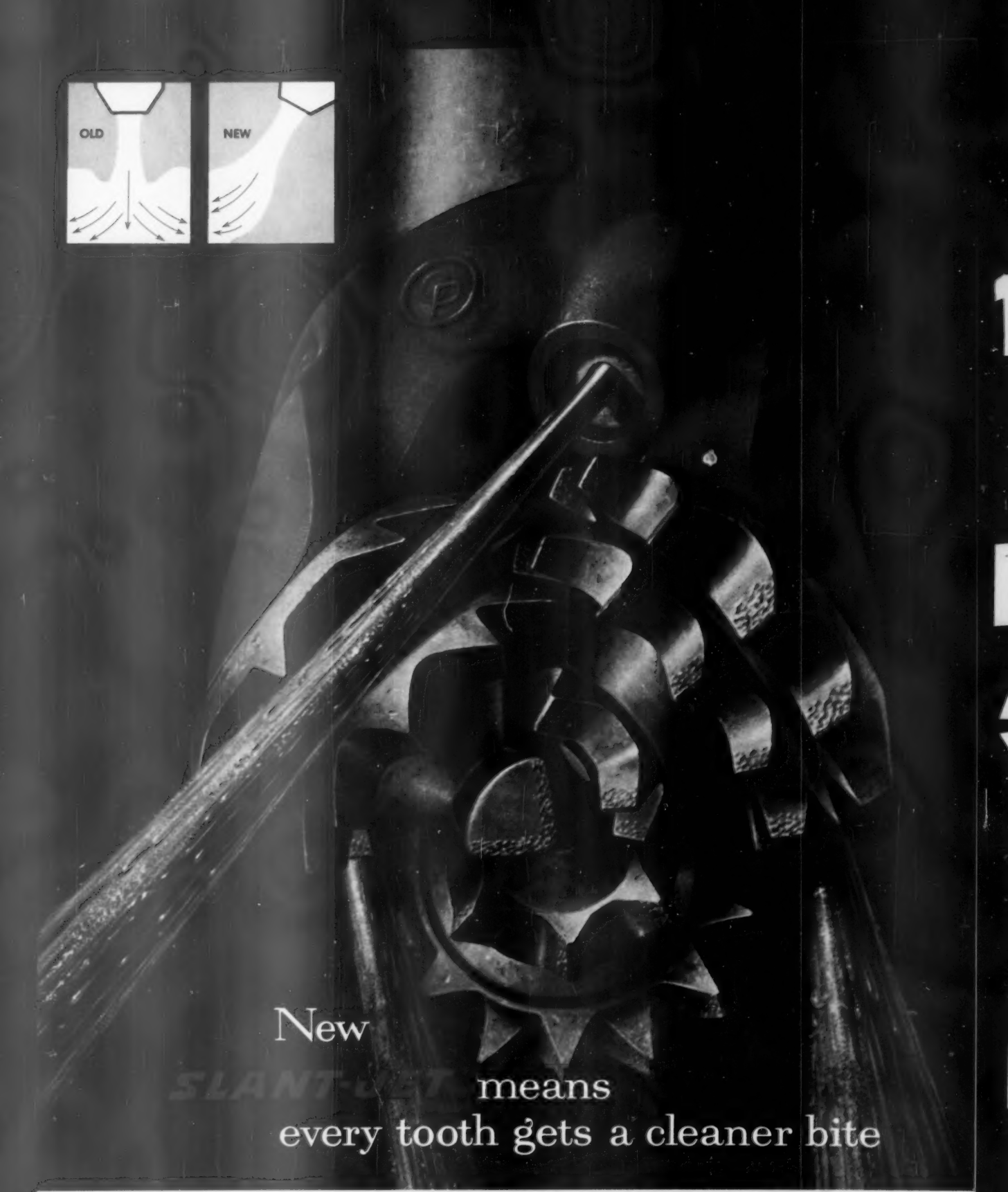

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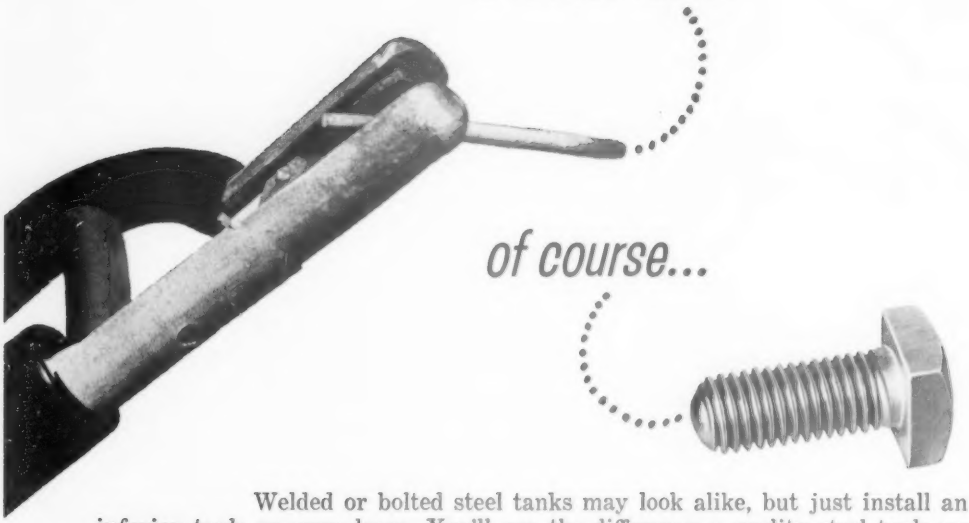

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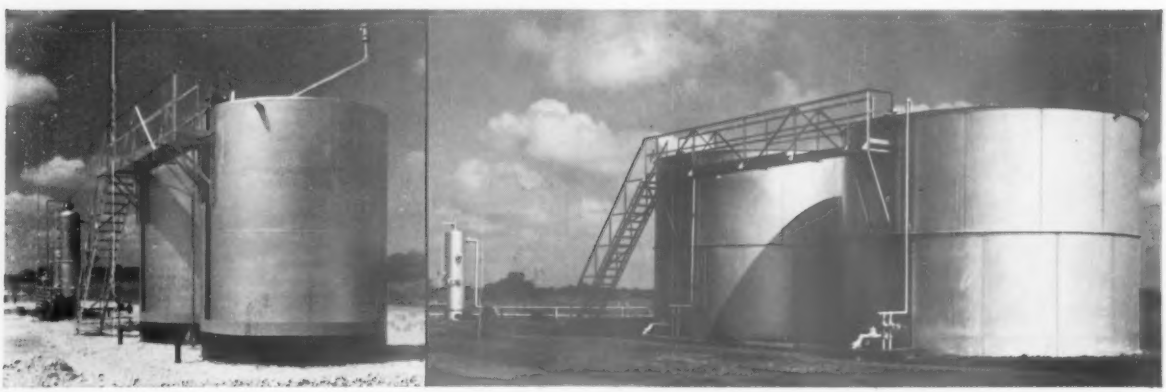

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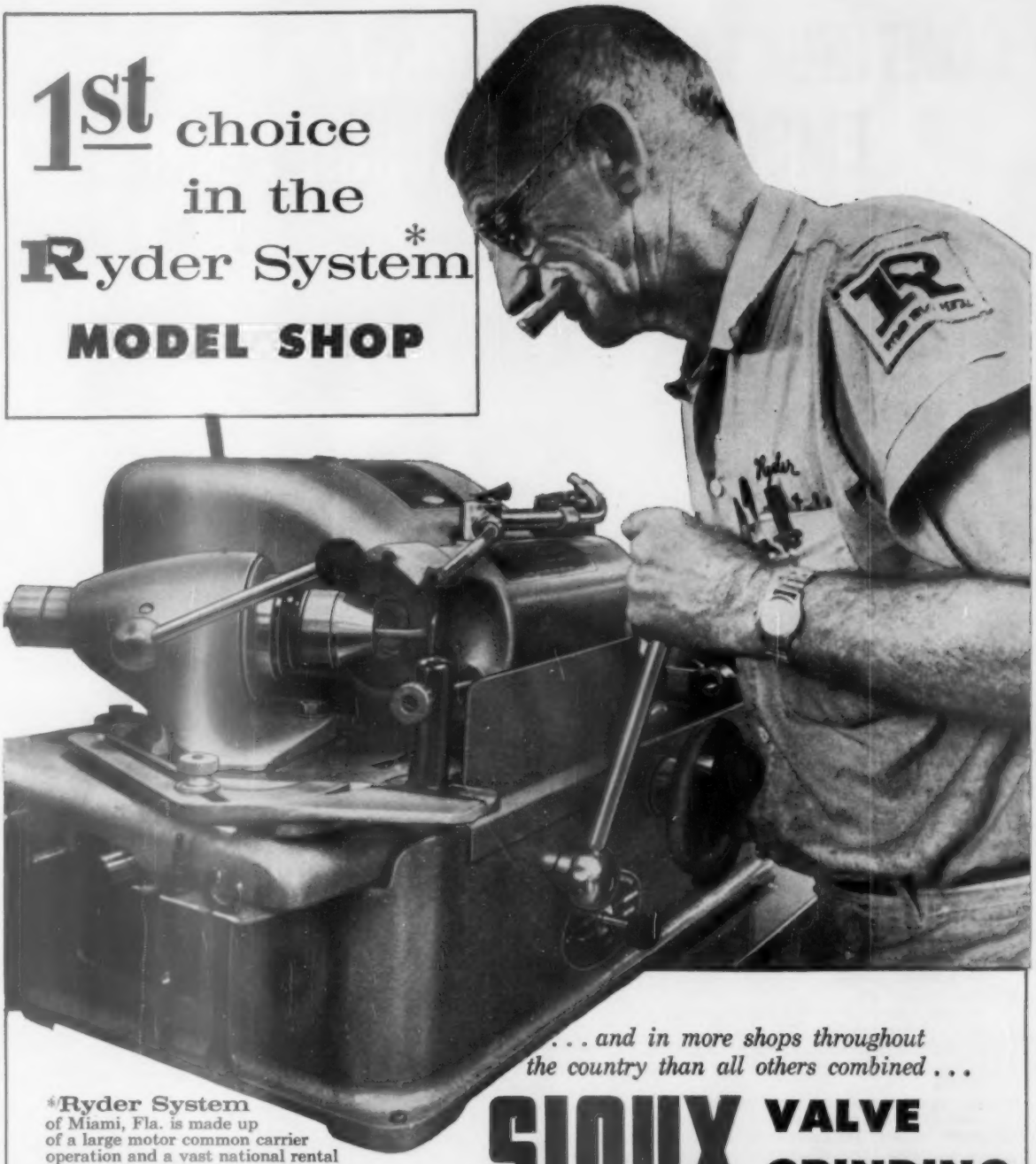

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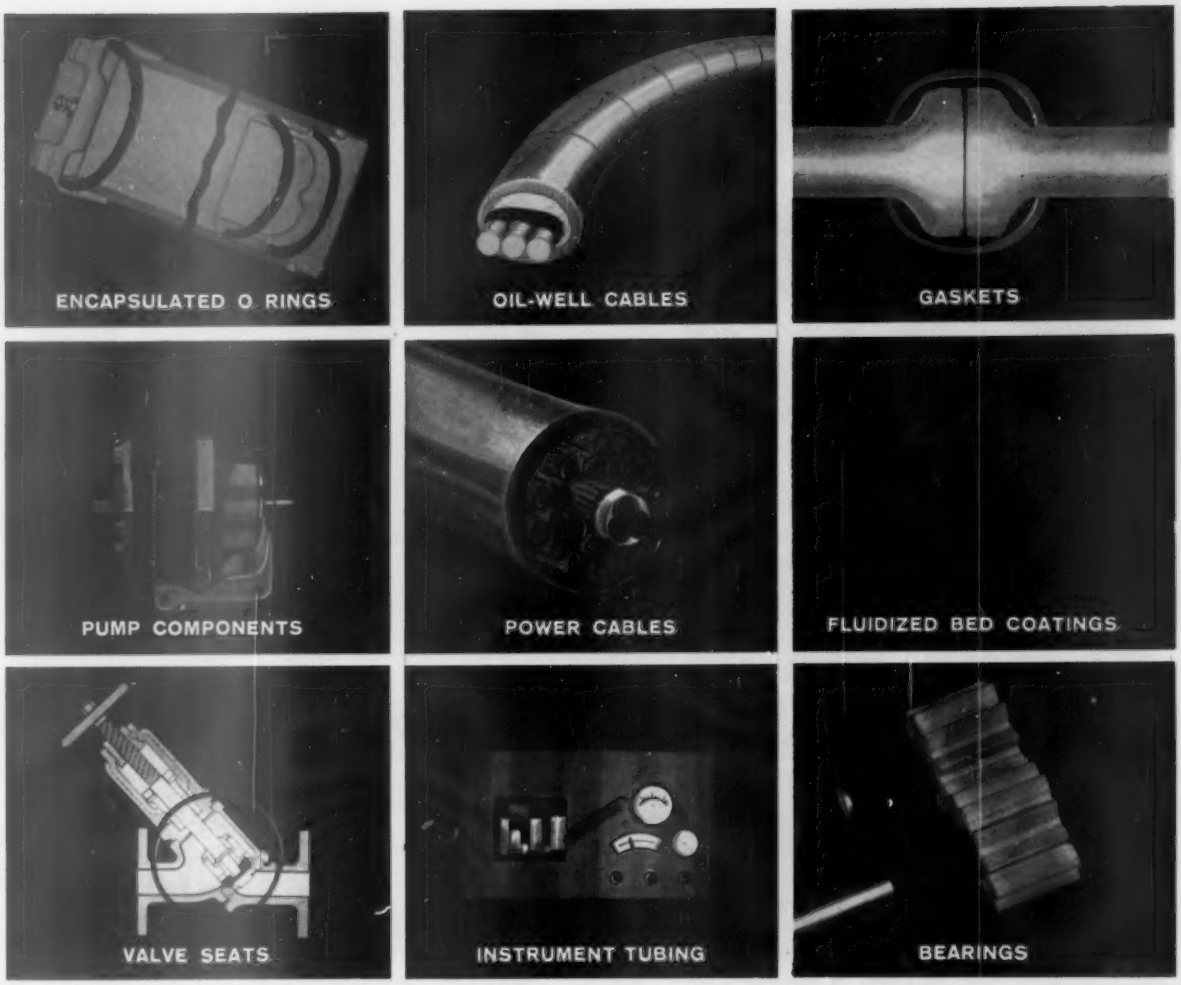

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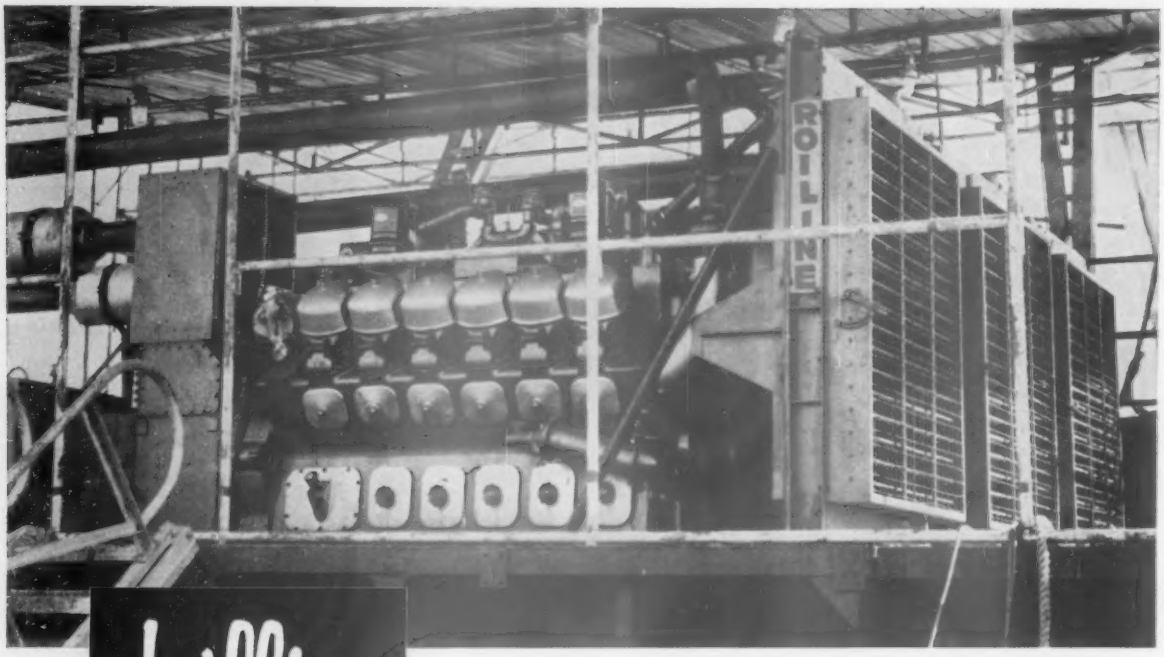

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Because of their V-12 cylinder design, light pistons, short radius rotating parts, and sensitive controls these Model L-3460 ROILINE Engines pick up a load fast.

Hydraulic "Zero lash" valve lifters eliminate tappet noise and adjustments and extend valve life. That means smooth, quiet engine operation and easier maintenance.

Exhaust manifold is water-cooled and integrally cast into the crankcase to provide cooler operating area and fast engine warm-up.

"Easy Flow" manifold design provides perfect fuel and air distribution to all cylinders through large individual intake ports. This advanced design manifolding . . . low friction bearings . . . low power loss to accessories—all contribute to ROILINES' remarkable economy of operation.

Send for descriptive Bulletin E-7.

WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN

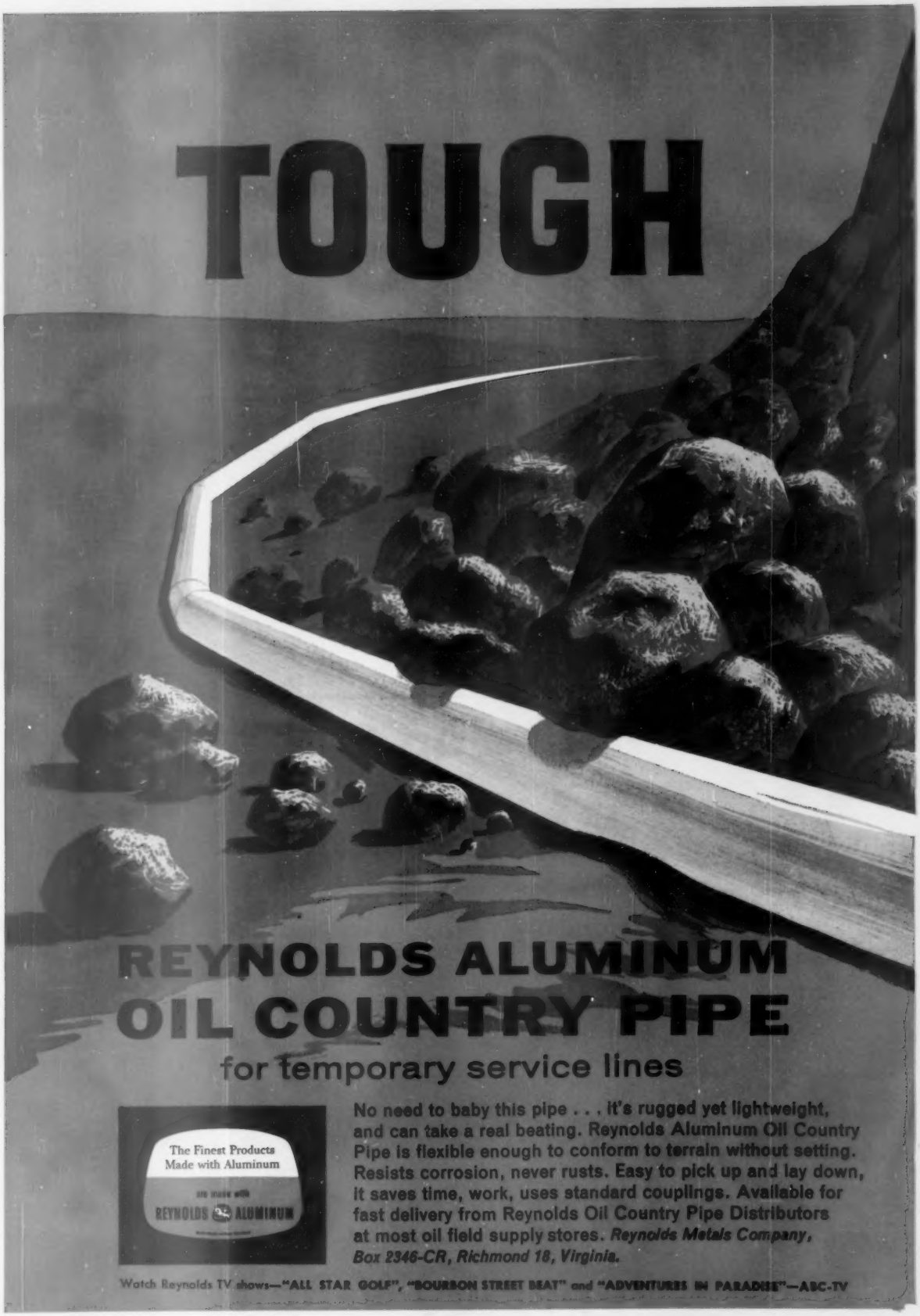
NEW YORK TULSA LOS ANGELES

Factories — Waukesha, Wisconsin, and Clinton, Iowa

486

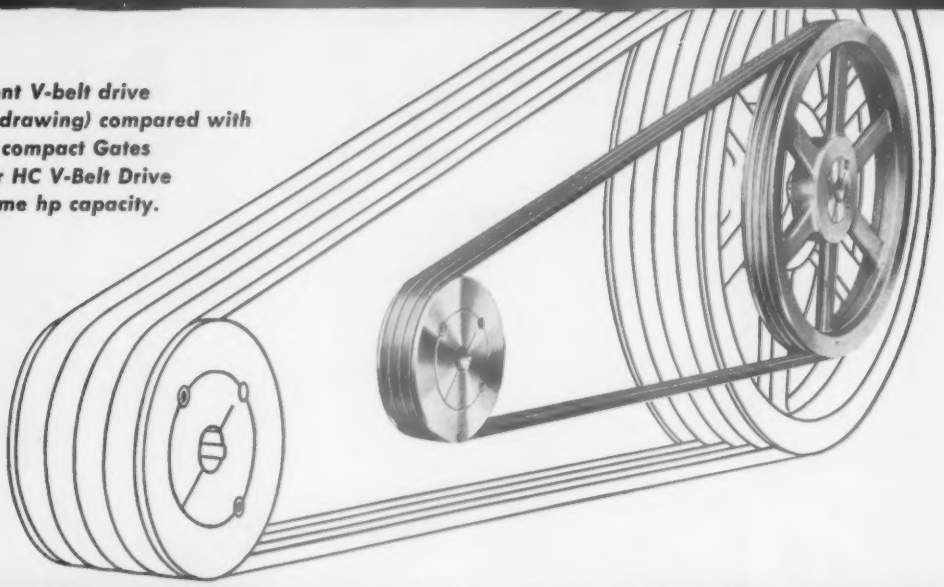
Model	Bore and Stroke	No. of Cyls.	Displ. Cu. In.	Max. Torque Lb./Ft. @ RPM	600	Brake Horsepower at Engine Speeds Indicated 800	1000	1200	1400	1600	1800	2000	2200	2400
H570	4⅛ x 4¼	8	570	490....1800		68	89	109	129	148	168	186	202	216
H844	5¼ x 4⅞	8	844	700....1200		104	133	160	185	209	232	252	263	272
F1500	6¾ x 7	6	1503	1170.... 600	134	176	214	230						
H2000	6¾ x 7	8	2004	1590.... 650	180	240	280	300						
L3000	6¾ x 7	12	3006	2420.... 650	275	360	435	460						
L3460	7¼ x 7	12	3468	2780.... 900	318	424	530	619	660 @ 1350 RPM					
L4000	7.54 x 7.5	12	4000	3280.... 800	385	500	615	706						

These are engine ratings on LP Gas . . . send for Power Chart with ratings for engines and complete power units operating on natural gas, LP Gas, and gasoline.

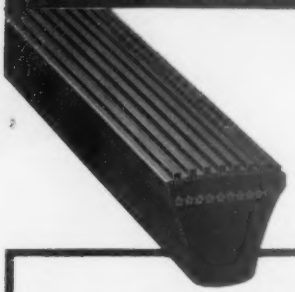

TOUGH
REYNOLDS ALUMINUM
OIL COUNTRY PIPE
for temporary service lines
The Finest Products
Made with Aluminum
are made with
REYNOLDS ALUMINUM
No need to baby this pipe . . . it's rugged yet lightweight, and can take a real beating. Reynolds Aluminum Oil Country Pipe is flexible enough to conform to terrain without setting. Resists corrosion, never rusts. Easy to pick up and lay down, it saves time, work, uses standard couplings. Available for fast delivery from Reynolds Oil Country Pipe Distributors at most oil field supply stores. Reynolds Metals Company, Box 2346-CR, Richmond 18, Virginia.
Watch Reynolds TV shows—"ALL STAR GOLF", "BOURBON STREET BEAT" and "ADVENTURES IN PARADISE"—ABC-TV

Designing NEW DRIVES?

Present V-belt drive (line drawing) compared with new, compact Gates Super HC V-Belt Drive of same hp capacity.



COMPARE: Left, typical drive with present V-belts. Right—drive of same hp capacity with Gates new Super HC V-Belts . . . uses fewer belts, smaller sheaves and shorter center distance.



For NEW drives on mud pumps Gates compact new Super HC V-Belt with the patented ribbed top cuts space required up to 50% and cost as much as 20%.

Gates

World's Largest Maker of V-Belts

Save up to 20%

with new high capacity V-belt drive

When you change the whole drive — on mud pump, pumping unit, or any other piece of petroleum equipment — remember: The cost of a Gates Super HC V-Belt is as much as 20% less than the cost of present V-belt drives of the same horsepower capacity.

A development of Specialized Research in the world's largest V-belt laboratories at Gates, the new Super HC V-Belt makes possible the most compact, lightest-weight, lowest-cost multiple V-belt drive you can put on any pump!

Cuts drive space as much as 50%

With Gates new Super HC V-Belt, sheave diameters and widths can be reduced 30% to 50%, center distances 20% and more. Bearing load is lightened and total space occupied by the drive may be cut as much as 50%.

"The Modern Way to Design Multiple V-Belt Drives" is an informative handbook on the Super HC Drive, available from your nearby Gates Distributor listed in the Yellow Pages of your phone book.

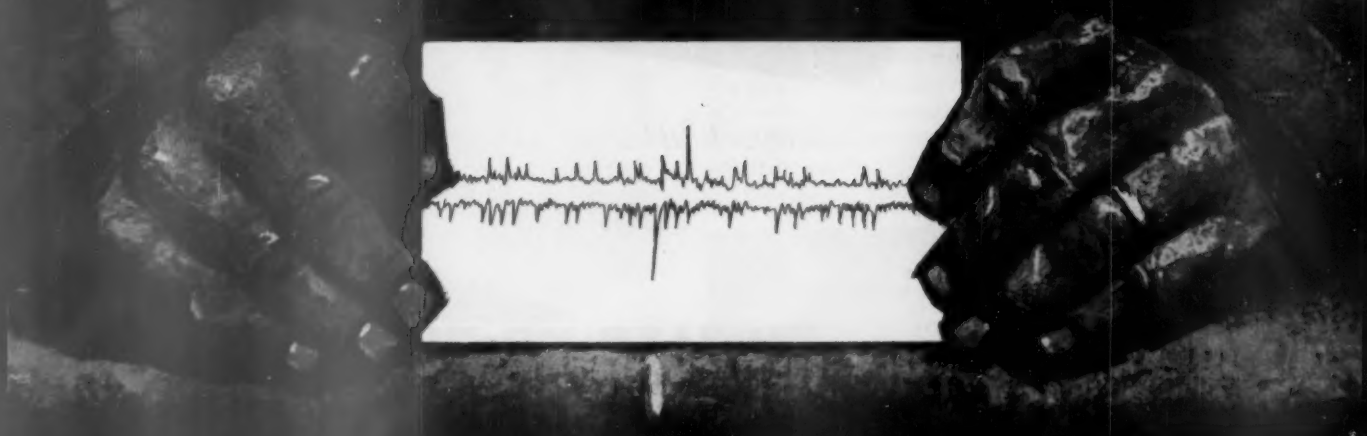
The Gates Rubber Company, Denver, Colorado

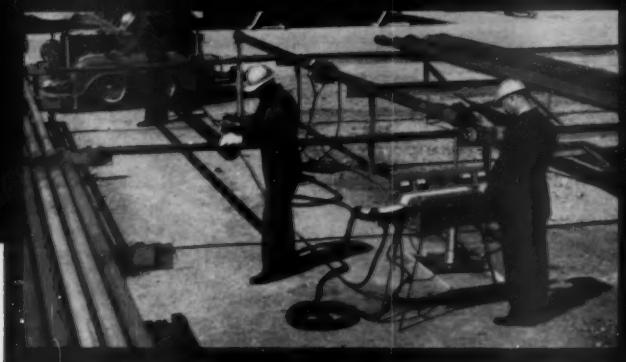
Gates Rubber of Canada Ltd., Brantford, Ont.

TPA 439B

Gates Super HC V-Belt Drives

SONOSCOPE inspection with MINIMAX*





"selects" and accurately evaluates drill pipe defects

MINIMAX is a 'defect selection' method used only in Tuboscope Company's SONOSCOPE tubular inspections. MINIMAX electronically selects, from multiple signals developed by pitting, cuts, fatigue cracks or other defects, the largest signal from any group of defects encountered at the same time. Therefore, when multiple defects are located within the same diametrical plane, the recorded indication represents the magnitude of *only* the worst defect in that plane.

There is no addition or cancellation of defect signals — you know the true condition of each length.

Insist on MINIMAX defect selection for the most economical protection against drill pipe failures. Call Tuboscope.

- QUANTITATIVE RESULTS
- PREVENTS WASTE OF USEABLE PIPE
- ELECTRONIC ACCURACY

"Selects" the worst defect in any one plane

The dangerous fatigue crack, often obscured by insignificant multiple corrosion pitting, is accurately recorded on the SONOSCOPE log.

The insignificant slip cut is ignored while the more serious crack is accurately evaluated.

Tuboscope®
COMPANY

SERVING THE OIL INDUSTRY THROUGH NON-DESTRUCTIVE TESTING

2919 HOLMES ROAD
HOUSTON 1, TEXAS

® Service Mark of Tuboscope Company * Service Mark Reg. U.S.A. and Canada

connect laterals under pressure

QUICKLY SAFELY SIMPLY

with the

MUELLER® NO-BLO® METHOD

■ *Only these simple operations are needed to quickly connect a 4" lateral under pressure to a steel line with a No-Blo Flanged Tee.*

1. WELD

Remove cap and loosen plug. Weld Flanged Tee to line. Weld lateral to Flanged Tee. Complete lateral to first shut-off. Test welds with soapsuds. Bolt gate valve—hand tight—to fitting and open valve.

2. ALIGN

Attach alignment tool and completion plug to shaft of H-17235 Stopping Machine. Bolt machine—hand tight—to gate valve. Align machine and valve with fitting. Insert plug into fitting and tighten bolts. Mark position of machine on valve. Remove completion plug and machine.

3. ASSEMBLE

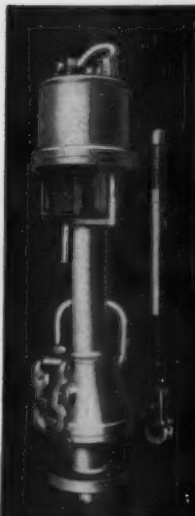
Bolt adapter to CH-6 Drilling Machine. Advance boring bar with rapid feed hand crank. Attach cutter arbor, pilot drill and shell cutter to boring bar. Retract boring bar to rearmost position. Bolt machine to the open gate valve.

Write for complete information and specifications.

H-17235 STOPPING MACHINE

■ Large lateral line connections can be made to existing lines in just a few minutes when your crew is equipped with a Mueller CH-6 Drilling Machine and H-17235 Stopping Machine. These compact machines are ideal for connecting 3″ and 4″ lines under pressure. Automatic operation of the "CH-6" simplifies the operator's job, assures safe operation and saves time.

These machines and fittings are just a small part of Mueller's complete system of No-Blo products—products especially designed for working with fluids under pressure.



CH-6 DRILLING MACHINE

- . . . makes cuts from 2″ to 6″
- . . . shell cutters designed for cutting any type pipe
- . . . up to 24″ boring bar travel
- . . . for pressures to 1440 p.s.i. at 100° F.
- . . . for temperatures to 500° F. at 1250 p.s.i.
- . . . features automatic operation without supervision
- . . . automatic feed disengagement and over-travel protection
- . . . direct reading tool position and feed indicators
- . . . telescopic design for handling ease
- . . . self-adjusting boring bar packing
- . . . for power operation with air or gasoline engine drive unit
- . . . may also be operated by hand

4. CUT

Test set-up for pressure tightness. Advance boring bar until pilot drill almost contacts line. Set amount of cut needed and engage automatic feed. Mount air motor on machine and open throttle. ("CH-6" will automatically make cut and disengage feed without supervision.) Lateral now in operation. Retract boring bar to rearmost position. Close gate valve and remove machine.

5. PLUG

Fasten inserting tool and completion plug to shaft of "H-17235." Bolt machine to gate valve in same position as marked. Open gate valve and insert plug solidly into top of fitting. Test tightness of plug with bypass valve. Release plug and remove machine and gate valve.

6. CAP

Position gasket on flange of fitting. Bolt completion cap firmly in place. Test entire set-up with soapsuds. Connection now completed and ready for backfilling.

MUELLER CO.,

DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario.

hē′li-ŭm

When you consider Helium-Recovery you will automatically think of Stearns-Roger.

Most of the operating helium plants in the free world have been built by Stearns-Roger. In this one organization is collected the cryogenic knowledge, experience and practical background to engineer and construct economical and satisfactory helium plants.

Stearns-Roger can provide you with reliable designs, investment studies and overall assistance in helium, hydrogen, natural gas and rare gas problems.

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FEEL IT . . .

SEE IT . . .

SMELL IT . . .

TASTE IT . . .

the SURE WAY to take guesswork out of well completions . . .

. . . is with a Johnston Drill Stem Test. Gives you information on which you can base a decision and be absolutely sure. It removes all doubt, actually puts you in touch with the formation. • Don't chance setting casing on a dry hole — don't pass up a producer.

Test to be certain of your well.

Get the job done faster and better, at less cost.

You get more from a Johnston Test. Call Johnston!

JOHNSTON TESTERS, INC.

P. O. Box 98 Houston 1, Texas

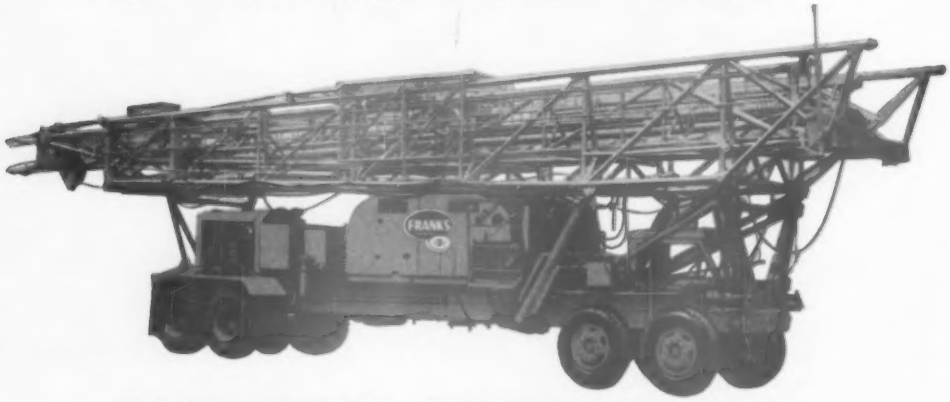
Explorer Rocket

THE MOST IMITATED

Explorer Cruiser

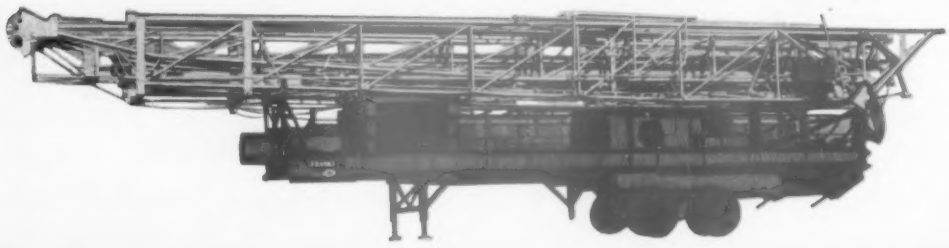
UNITS IN THE FIELD...

Clipper



Comet

BUT NOT DUPLICATED



OFTEN IMITATED . . . NEVER DUPLICATED

WORTH MORE WHEN YOU BUY 'EM
WORTH MORE WHEN YOU TRADE 'EM

Common sense will tell you that there **is** a difference in most things despite the tendency to imitate the leader. There's a difference in baseball players . . . in cooks . . . yes, even in oil well servicing units . . . although competitive units are getting to look mighty like the Franks Explorer.

Now, this **difference** is what keeps the Franks Explorer ahead of the pack. It's the difference which makes superintendents prefer Franks units on their jobs. It's the difference you feel in your pocketbook when you trade it in. The higher resale value of Franks Explorers speaks louder of this difference than any words we can dream up.

Ask the man who uses Franks!

"WORTH MORE" FRANKS FEATURES

- Full view control console
- Engineered weight distribution
- True capacity rated derricks, 100,000 to 275,000#
- Less downtime thru industrial engine economy, power and dependability
- High resale value as used equipment
- Field acceptance established

ON THE SPOT . . . 'ROUND THE CLOCK . . . FIELD SERVICE

WELL SERVICING AND DRILLING UNITS
FRANKS
DIVISION OF
PAMPA, TEXAS
CABOT SHOPS, INC.

OFTEN IMITATED . . . NEVER DUPLICATED

UNITED

UNITED REFINING COMPANY SELECTS KELLOGG CASCADE-TYPE SULFURIC ACID ALKYLATION UNIT AS BEST OF ALL DESIGNS

Low-Investment 1100 BPD Unit Will Increase Octane and Reduce Sensitivity at Minimum Operating Cost

United Refining Company, Pennsylvania's largest independent oil refiner, has an eye for economy.

Faced with a need for producing high quality motor alkylate from a high propylene-content feed, United selected an 1100 BPD Kellogg alkylation unit. A sulfuric acid design, utilizing Kellogg's multi-stage reactor, the unit is a recent development of previous Kellogg units of this type. It will be erected at United's 15,000 BPD refinery at Warren, Pa.

In awarding Kellogg a lump-sum contract for the design, procurement, and construction of this alkylation unit, United chose a route that many refiners, both large and small, would find to be the shortest and most economical way to meet market demands.

Initial Investment is Lower

Kellogg sulfuric acid alkylation units are designed to minimize the use of costly materials and fabricating procedures. Yet they assure long life by reducing corrosion problems to a minimum without heavy use of expensive chemicals.

Operating Costs are Lower

Kellogg's new design offers a very low sulfuric acid consumption per gallon of alkylate produced. Because the Kellogg design is flexible in its use of available utilities, the total operating *cost* may be minimized to suit local conditions.

Operation is Flexible

Kellogg units can operate on butylene, propylene, or a combination feed. In addition to producing high octane alkylate, they can produce an LPG product without supplementary towers or equipment.

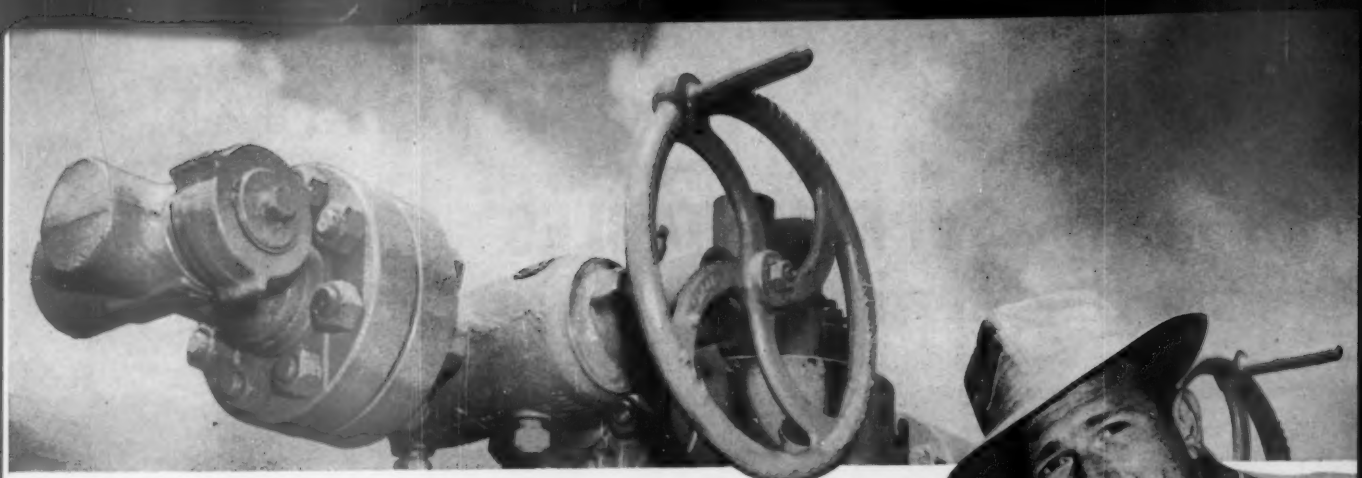
Whether 500 or 15,000 BPD, a Kellogg-designed alkylation unit is a better investment today than ever before. Kellogg welcomes the opportunity to discuss the details of its process as they apply to your specific needs.

THE M. W. KELLOGG COMPANY, 711 THIRD AVENUE, NEW YORK 17, N.Y.

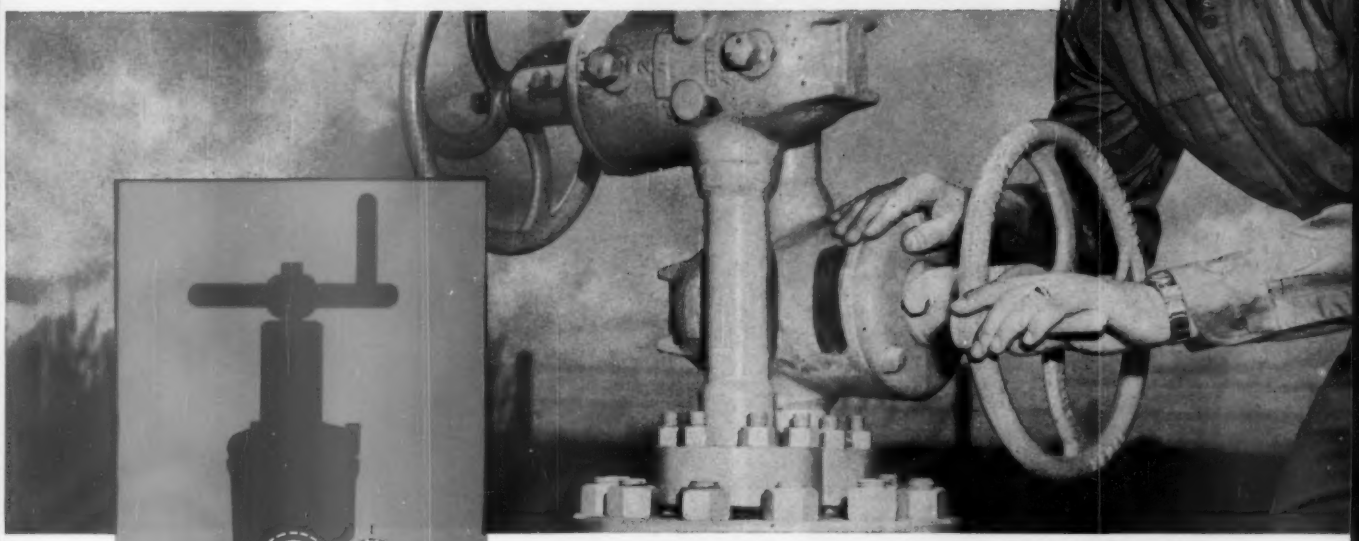
A SUBSIDIARY OF PULLMAN INCORPORATED

The Canadian Kellogg Company, Limited, Toronto • Kellogg International Corporation, London • Kellogg Pan American Corporation, Buenos Aires Societe Kellogg, Paris • Companhia Kellogg Brasileira, Rio de Janeiro • Companhia Kellogg de Venezuela, Caracas

M KELLOGG W



"No other valve gives such a perfect seal"



W-K-M Recessed Body Valves feature through-conduit gate construction, pressure seal bonnets, super-finished stems supported on roller bearings — and can be overhauled on-the-line.

Sizes: 1½", 1¾", 2", 2½" and 3". Working Pressures: 2000 through 5000 pounds.

PRODUCT OF W-K-M's *Creative Engineering*

W-K-M® Recessed Body Valves for Multiple Completions

No other valves give you such tight sealing, such dependable control.

W-K-M's Controlled Force Seating creates an initial bubble-tight seal between the gate and Teflon inserts. As the gate assembly expands, a tight metal-to-metal seal is achieved. Result: a perfect *Double Tight Seal* without body or seat lubrication.

Next time — and every time — specify W-K-M! Recessed Body Valves are available for dual and triple completions. *At leading supply stores everywhere.*

WRITE FOR CATALOG 200

W-K-M

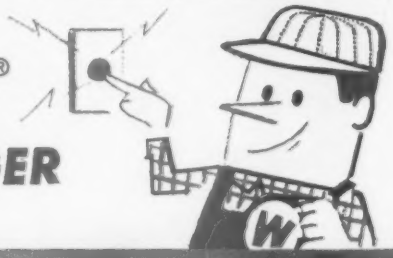
DIVISION OF ACF INDUSTRIES INCORPORATED
P. O. BOX 2117, HOUSTON, TEXAS

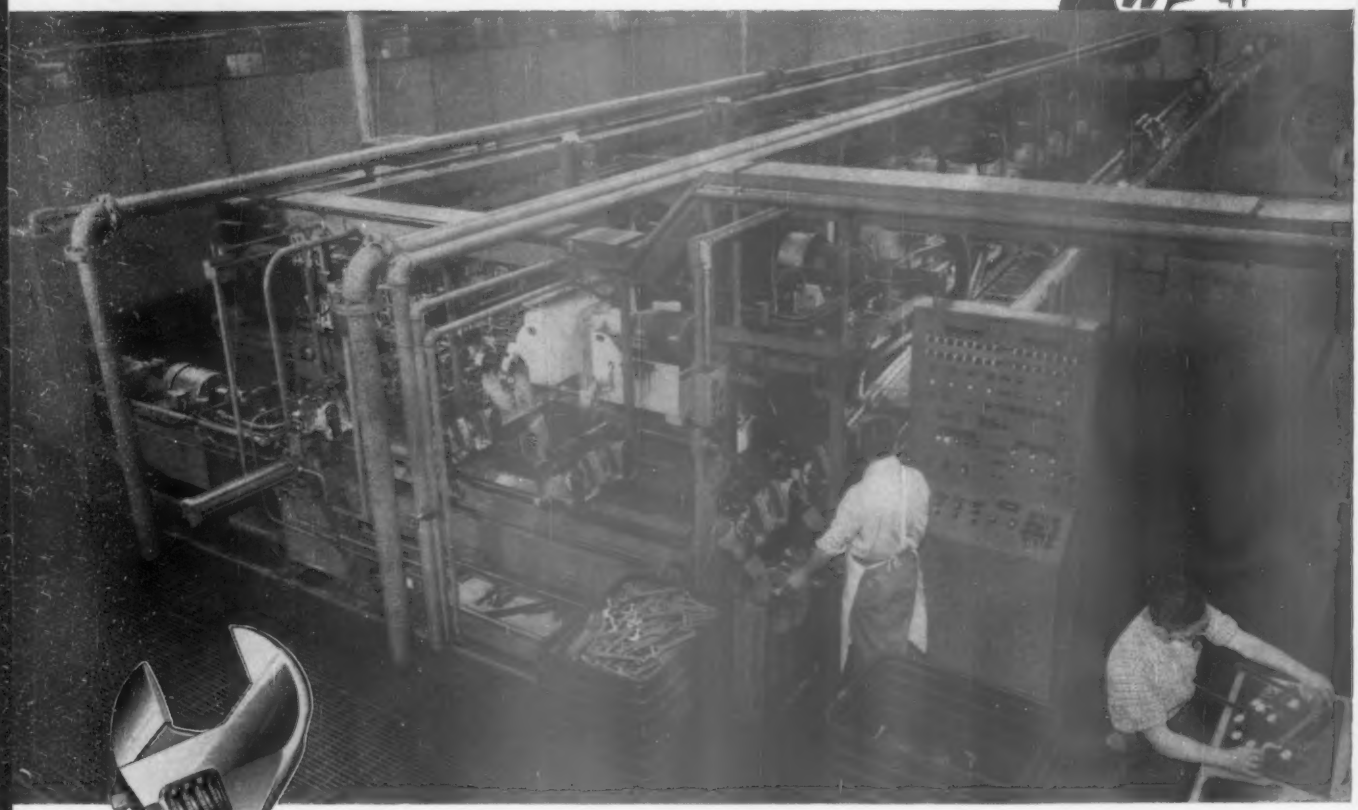
5906-R

It's a Push-Button World at WILLIAMS

that's why SUPERJUSTABLES®

WORK BETTER • LAST LONGER





• AUTOMATED MACHINING guarantees smooth adjustment, exact fit in every wrench. This million dollar transfer machine was designed especially for Williams' Superjustable® wrench production. A push of a button puts 28 stations in operation... consistently machining to uniformly close tolerances. Fully machined wrench heads are constantly checked on special gauges to further insure perfect fit with sliding jaws, worms, pins and springs. No other manufacturer has this automated equipment to so precisely machine wrenches that *work better... last longer.*

Send for New Catalog No. 304. Lists over 4530 Stock Wrenches, Tools and Forgings... the Broadest Line of its kind.

WILLIAMS

J. H. WILLIAMS & CO.
DIVISION OF UNITED-GREENFIELD CORPORATION
415 VULCAN STREET • BUFFALO 7, NEW YORK

TOOLS of INDUSTRY

Superjustables® are available in regular or locking styles in sizes ranging from 4 to 24 inches, Black or Chrome finish.

Would you spend an extra 10%

to double roller chain life?

Morse H-E Roller Chain overcomes metal fatigue . . .

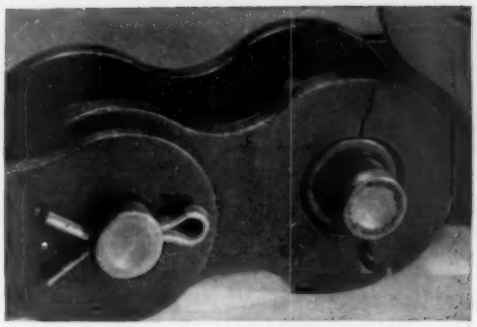
lasts from 2 to 5 times longer . . .

costs only 10 per cent more than ordinary roller chain!

Yes, now by paying just a slight premium you can buy Morse H-E (high endurance) roller chain . . . and get 2 to 5 times the service life over ordinary chain. You'll save thousands of dollars annually on tough drilling jobs. Here's why:

Normal roller chain breaks under heavy strain in oil-field applications. It's this "tired metal" problem that plagues anyone who has used roller chain. Morse has developed a process to overcome metal fatigue. As a result, Morse H-E Roller Chain has a 95% greater endurance limit . . . lasts up to 500% longer . . . costs just 10% more.

Morse H-E Roller Chain is available from 1″ through 2½″ pitch, standard and heavy series, single and multiple widths. Make a test on your own rig. Your local supply store is the place to start. Or write: Morse Chain Company, Dept. 22-50, Ithaca, N.Y. Warehouses in Casper, Wyo., Houston and Odessa, Tex., Farmington and Hobbs, N.M., Los Angeles. Export Sales: Borg-Warner Intl., Chicago 3, Ill. In Canada: Morse Chain of Canada, Ltd., Simcoe, Ont.

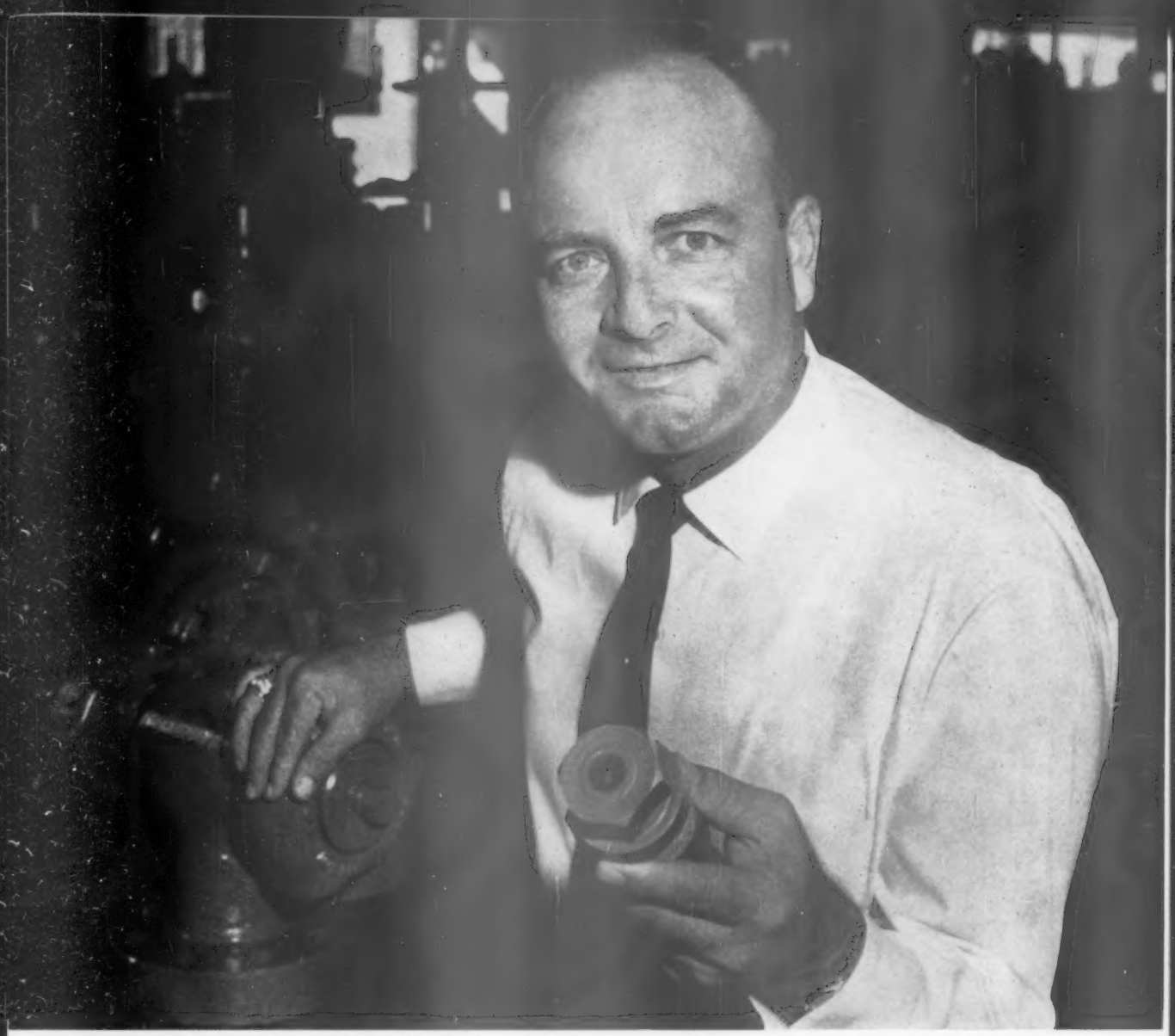


ORDINARY CHAIN BREAKS when the side plate tires from repetitive loading and unloading during the cycle around the sprockets. But Morse H-E Roller Chain has a 95% higher endurance limit . . . outlasts ordinary chain by up to 5 to 1 under repeated loading.

MORSE BW

A BORG-WARNER INDUSTRY

ONLY MORSE OFFERS ALL FOUR: Roller Chain, Silent Chain, Hy-Vo® and "Timing"® Belts



This bean lasts for the flowing life of a well!

Low cost, renewable inserts take the cutting action

With ordinary care, a single UNIBOLT Master Bean will last for the entire flowing life of a well. These beans are threaded to receive an inexpensive screw insert. The cutting action of sand-laden production is imposed on the expendable insert, not the master bean.

The inserts are not only inexpensive, they are easier to change than regular beans. Drilled in increments of 5% and 10% of well flow, as well as in increments of 1/64th inch, these inserts provide the versatile range of an adjustable choke with the fine accuracy of a positive orifice.

This is only one of a number of refinements in flow bean design perfected and introduced by UNIBOLT. Others are: shaped entrance to reduce turbulence and maintain flow accuracy, "flow-rating" as a standard inspection procedure to insure correct orifice sizing, and special analysis alloys and heat-treatments for corrosion and wear resistance.

UNIBOLT flow beans are designed to fit only UNIBOLT Positive Choke Bodies and Cage Nipples.

Request UNIBOLT Positive Choke Bodies and Cage Nipples from your Christmas tree supplier and be assured of the finest in dependable flow control.

Unibolt screw inserts are easy to change, and they protect the master bean against cutting.

UNIBOLT

THORNHILL CRAVER CO.

P. O. Box 1184, Houston, Texas

WELL CONTROLLED INVENTORIES

at WILSON SUPPLY

The Wilson Supply store manager in your area anticipates your equipment and supply needs. In most cases, he can deliver what you want when you want it — right out of stock. There are 22 Wilson Supply stores in Texas, Oklahoma, Louisiana and New Mexico ready to serve you 'round the clock.

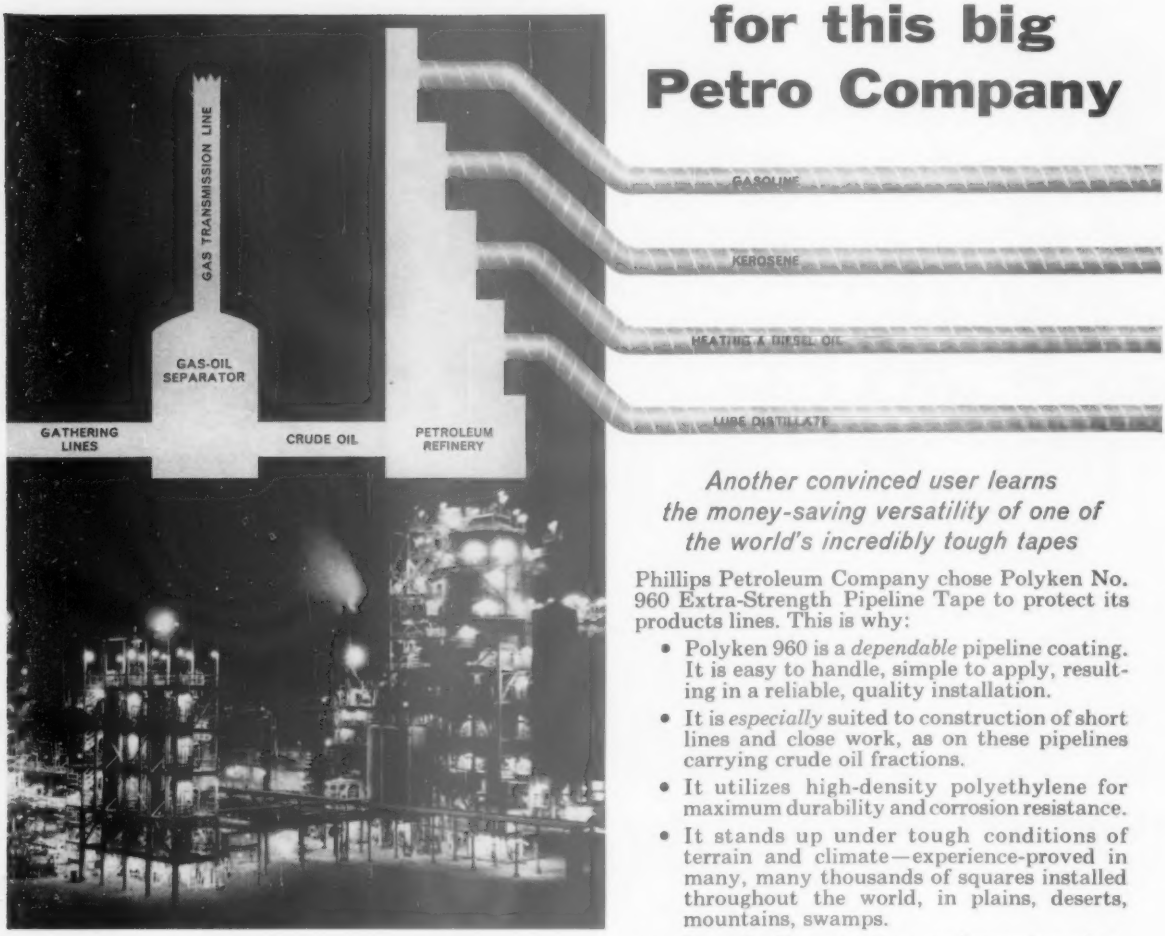
"WHAT YOU WANT – WHEN YOU WANT IT"

WILSON SUPPLY CO
HOUSTON, TEXAS

6015

Polyken tape protects products lines

for this big Petro Company



Another convinced user learns the money-saving versatility of one of the world's incredibly tough tapes

Phillips Petroleum Company chose Polyken No. 960 Extra-Strength Pipeline Tape to protect its products lines. This is why:

- Polyken 960 is a *dependable* pipeline coating. It is easy to handle, simple to apply, resulting in a reliable, quality installation.
- It is *especially* suited to construction of short lines and close work, as on these pipelines carrying crude oil fractions.
- It utilizes high-density polyethylene for maximum durability and corrosion resistance.
- It stands up under tough conditions of terrain and climate—experience-proved in many, many thousands of squares installed throughout the world, in plains, deserts, mountains, swamps.
- Its cathodic protection requirements are low.

AND . . .

- It saves money: Polyken 960 goes on fast with less men per job, covers more miles per day. Less equipment, less handling costs. More savings over the old hot dope idea.

See your Polyken Man . . . call your Polyken Tape Coating Distributor . . . or write Polyken, 309 West Jackson Blvd., Chicago 6, Illinois.

©1960 The Kendall Company

Phillips pipe is cleaned and wrapped by Brodie Construction Company in a single factory-smooth operation. No primer, no drying or cooling. No fumes or fire hazards.

Polyken®

EXPERIENCED IN PROTECTIVE COATINGS

THE KENDALL COMPANY
Polyken Sales Division

ALLIS-CHALMERS

This maintenance man's toolbox sums up the story of

the simplest process in petroleum:

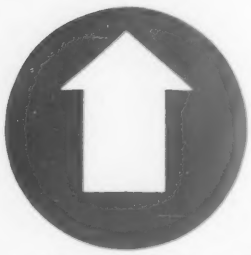
maintaining the products of Allis-Chalmers
Even the standard products Allis-Chalmers builds for petroleum — for production, pipelining and refining — are designed for the industry's special requirements... and designed so routine inspection and maintenance are simply, quickly done.

And from no other manufacturer can you match the range of equipment available and benefit from Allis-Chalmers unit responsibility. Listed at right are some of the Allis-Chalmers products built to serve you economically throughout the plant—from crude to finished product.

For service that matches the quality of the equipment, call the A-C representative near you. Or write ***Allis-Chalmers,*** *Milwaukee 1, Wisconsin.*

"Teamed" Equipment from A-C . . . Electrical Generation and Distribution Equipment. Centrifugal and Rotary Vacuum Pumps, Motors, Motor-Generators, Motor Control, Blowers, Compressors, Water Conditioning, Earth Moving and Material Handling Equipment. A-1276

Magcobar
Technology
Gets
YOU
UP

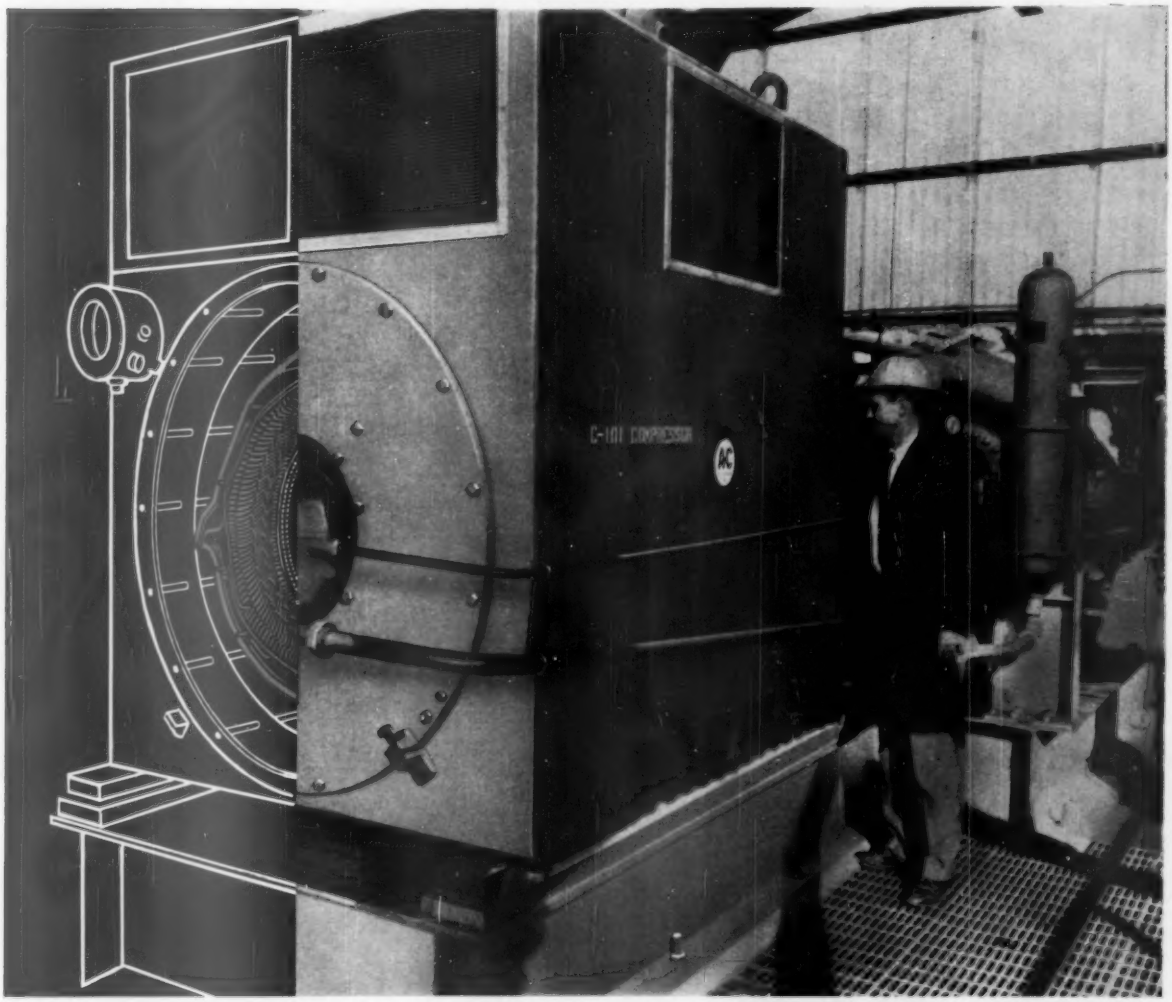


Gets the Hole Down

The shortest distance between two points — spudding in and TD — can be the straight line between the Magcobar planned mud program and drilling economy. If you are responsible for drilling — if it's your well or you're drilling it — you will find that a planned mud program built on Magcobar Technology will help you increase drilling speed and cut drilling costs.

Magcobar Technology can be your best assurance of success. This combination of the right products used right has been proved in every type of drilling around the world. Difficult wells are smoothed out; routine wells are drilled faster and with better production results. You can get to the bottom of most problems by beginning at the top to plan your wells with the Magcobar mud engineer. He will give you a lift on your way up as the drill goes down.

ALLIS-CHALMERS



Silco-Flex insulation in this refinery application has solved the problems of outdoor service — moisture, corrosive fumes, abrasive dust, and temperature extremes.

Your major motor investments are protected by Allis-Chalmers

invisible standards of perfection

Allis-Chalmers motors prove the value of thinking beyond established design standards. This thinking, applied to research, development and manufacturing, has led to advanced design features which mean greater application versatility, exceptional reliability and extended motor life. These are invisible standards of perfection you get with Allis-Chalmers motors.

Silco-Flex insulation, for example, has completely changed the rules on open-motor application. It is impervious to moisture, oils, and most acids, alkalies and solvents. It is resistant to abrasion, and is capable of withstanding high temperatures. Its resilience provides durability to withstand shock and vibration.

Super-Seal motors, with *Silco-Flex* insulation, have proved themselves for more than five years under the most severe conditions in industry.

Advancements such as capsule bearings, split end housings, and *Integrated* field coils (for synchronous motors) add to the superior performance of *Super-Seal* motors.

They contribute to the invisible standards that protect your motor investments year after year — cut replacement costs — assure uninterrupted production.

To learn more, call your nearby A-C representative, or write **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wisconsin.* A-1295

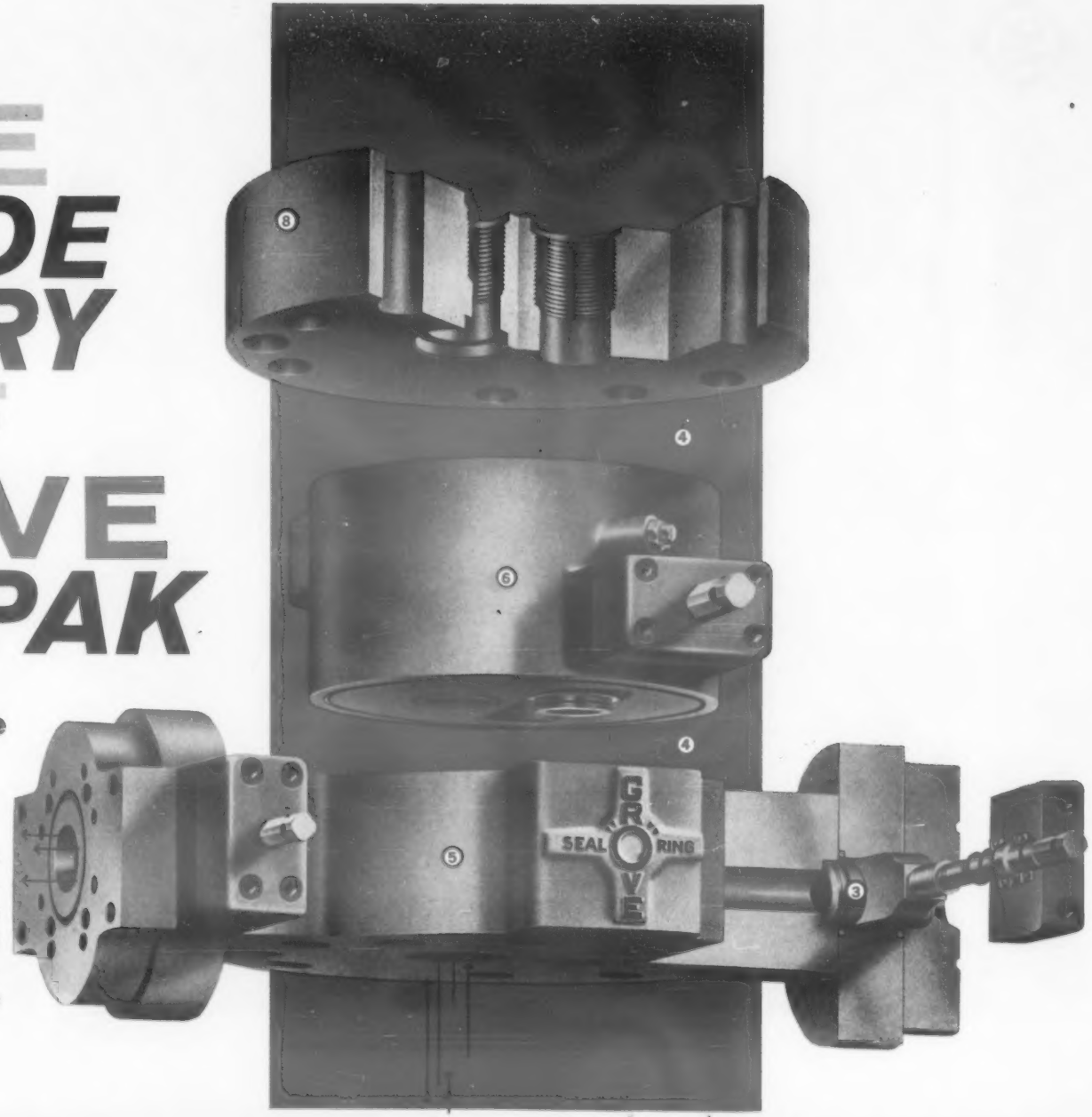
Super-Seal and Silco-Flex are Allis-Chalmers trademarks.

THE INSIDE STORY OF GROVE VALV-PAK

Compact • Versatile

Trouble-Free

Grove Seal-"O"-Ring® Valv-Pak combines the compactness and light weight of an integral Christmas Tree valve assembly with the flexibility of a conventional wellhead manifold that permits any single component to be changed without replacing the complete unit.



CHECK THESE GROVE VALV-PAK FEATURES:

1. Patented Grove Seal-"O"-Ring design for double-action seal. Metal inner seat rings give primary metal-to-metal seal backed up by O-Rings.
2. Precision-finished stems with lifetime lubricated ball bearings.
3. No lubricants or sealing compounds needed. Squeegee action of O-Rings against gate assures a clean polished surface for bubble-tight metal-to-metal seal.
4. Adaptable to meet any need. Unique Grove Valv-Pak construction gives ultimate flexibility. Valv-Pak can be factory tailored to your precise needs. Parts damaged by erosion or corrosion may be replaced in the field faster and more economically than with conventional designs.
5. Wing valve cross can be furnished in full opening or reduced port design.
6. Swabbing valve (optional).
7. Through conduit, full opening design for ideal flow characteristics and for accommodating down-hole tools.
8. Top and bottom flanges may be supplied to accommodate any wellhead fabricator's specification.
9. Studs furnished for all flanged outlets.

GROVE PRODUCTION VALVES

GROVE VALVE AND REGULATOR COMPANY
A Subsidiary of Walworth

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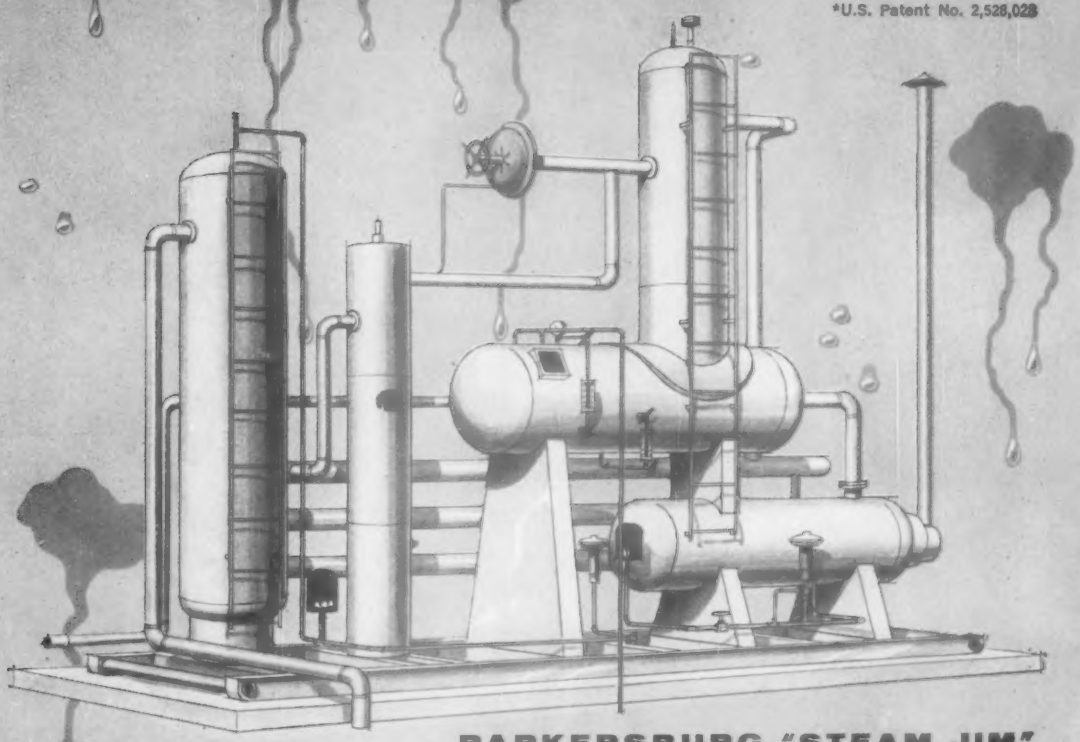
Offices throughout the United States and in Western Canada

WE'RE ALL

"STEAMED UP"!

. . . about the steam generator we've added to our "Slim Jim" Hyreco unit. You gain two ways . . . complete unit portability and less capital investment . . . and, of course, the patented* T-Bone design in our "Steam Jim" is the outstanding cold separation unit in the industry. Minimum gas reheating, minimum fuel requirements, and minimum corrosion problems are additional bonus values with this Parkersburg unit. Parkersburg's Hyreco low-temperature separation process sets the standard for the petroleum industry.

*U.S. Patent No. 2,528,028



PARKERSBURG "STEAM JIM"

HYRECO LOW-TEMPERATURE SEPARATION UNIT

PLUS FEATURES

- Removable firetube
- Factory-insulated
- Aluminum cover
- Unitized or remote-mounted
- Completely piped for field installation

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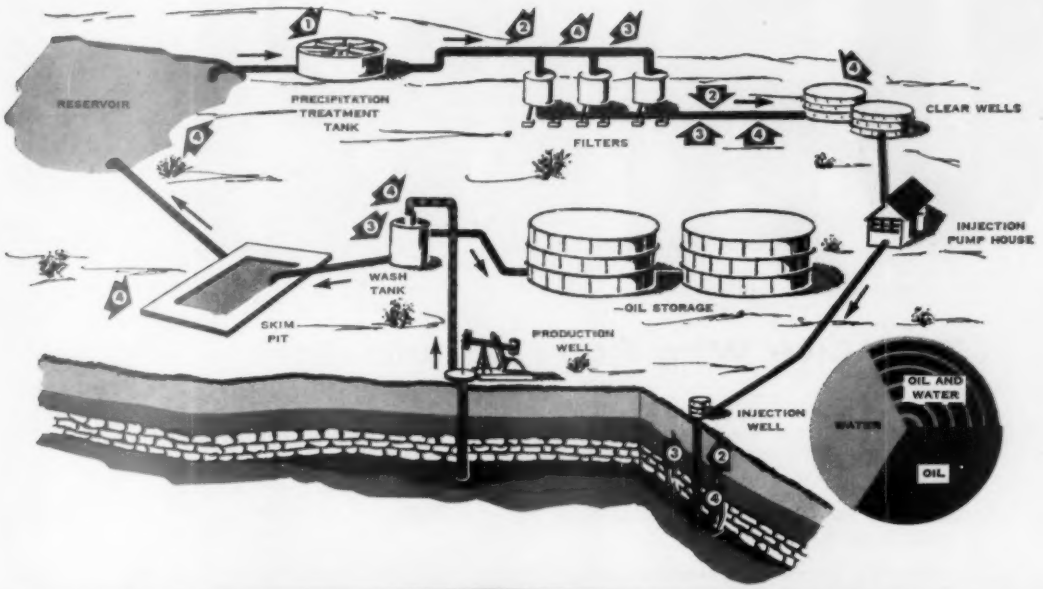
Division of Parkersburg-Aetna Corp.

PARKERSBURG • HOUSTON • COFFEYVILLE

PARKERSBURG—The FULL LINE in Pressure Vessels . . . Separators, Metering Equipment, Treaters, Heaters, Knockouts and Oil Skimmers, Scrubbers, Hyrecos, Hydrocarbon Recovery Units, Glycol Dehydrators, Stabilizers.

Continuous High Input with *Visco*® Water Flood Treatments



1 TURBIDITY REMOVAL
Clarification of raw water with efficient coagulants assures better floc formation, faster settling of solids.

2 CORROSION CONTROL
Polyphosphates or organic film forming inhibitors protect pipe lines and equipment against corrosive attack.

3 SCALE PREVENTION
Stabilizing treatments keep scale-forming salts in solution and maintain clean lines and an open formation with large water input volume.

4 MICROBIOLOGICAL CONTROL
Microbiological treatments help maintain clean equipment and an open formation by controlling slime, algae and sulfate reducing bacteria.

Treatments for water flood operations add up to continuous high input, low pumping costs, elimination of acidizing and back flushing and lower over-all operating and maintenance costs. Check the diagram above for points where the Visco Chemicals and Services work to improve water flood efficiency . . . Your Visco Field Service Man will be glad to work with you on any problems you have. His experience is backed by the entire facilities and skills of the world's largest water treatment organization.

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INCORPORATED
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UNION

The *Live Wire Rope Organization

Charged with creative energy

To be dubbed "live wire" by customers is nice. But it also is a warning signal which alerts our organization to stay alive to the fact that a greater output of creative energy is necessary when you're in front running position.

In the Union research laboratory and in those of the steel producing organization in which Union is integrated, technicians are hard at work on many new projects. They were started and will be finalized in the field where Union engineers spend more time than in the laboratory.

Classic example of what results from such deep and constant probing is the Tuffy family of wire ropes and slings, each one of them engineered to a specific job.

Among the 1600 standard wire rope constructions, in day to day production, none could be classified as the ultimate low-cost rope on rotary drilling rigs. Many months of experiments in the oil fields convinced Union Wire Rope engineers that rotary rigs called for an entirely new wire rope construction. In the Union laboratory testing equipment unlike any before used was set to simulate rotary rig operation and to impose wear and load factors far beyond those apt to be met in the deepest drilling. Many new wire and strand formulations met destruction before Tuffy Rotary Line was put together.

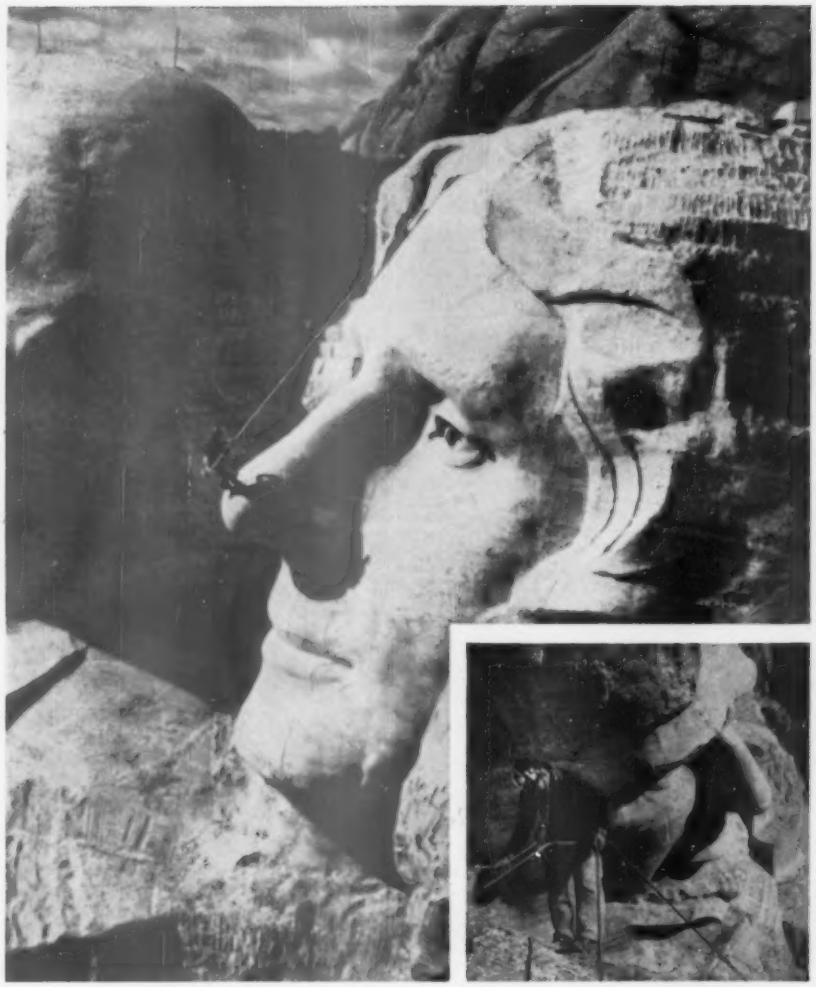
Thousands of applications on all types of rotary rigs, including the one on the deepest oil well, have established the unchallenged supremacy of —

"Ton-Mile" Engineered Tuffy Rotary Lines

Tuffy Standard Rotary Line is "ton-mile" engineered for standard and for large jackknife rotary rigs. Tuffy Jackknife Rotary Line is for drilling to depths up to 6,000 feet with the smaller jackknife rigs.

Union Wire Ropes For Well Servicing

For ultimate low-cost servicing ropes Union rod and tube pulling lines, rod hanger line, sand and pump line, cable tool drilling line and winch line.

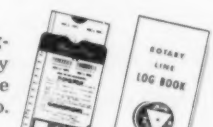


At Mount Rushmore National Memorial in South Dakota small fissures in the sculptured faces of Washington, Jefferson, Lincoln and Roosevelt are being sealed with granite dust and white lead. Though the granite sculpture is estimated to last for thousands of years, this preventive maintenance will keep the surfaces smooth and slow the natural erosion process. The insert shows how workmen are suspended on Union Wire Rope.

Worldwide Distribution . . . Not far from wherever you produce or seek oil you'll find Tuffy Rotary Line and standard Union Well Servicing Ropes. You get service on schedule and the ultimate low cost wire ropes at leading oil field supply stores.

Ton Mile Indicator

This slide chart provides you a quick, easy method of figuring ton-miles in following the cut-off practice originally developed by Union engineers. Write Union Wire Rope Corporation, 2102 Manchester Ave., Kansas City 26, Mo.



2-0

Tuffy. Wire Rope Tips

Guard Against These Killers!...Get the Full Measure of Service-Life Built In By Wire Rope Specialists.

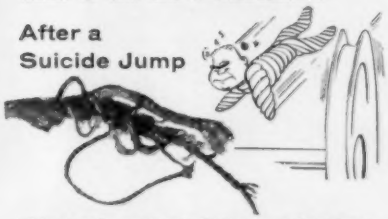
Rusty Road to Ruin

Rust—No. 1 enemy of steel—takes a heavy toll in wire rope life. The one-strand break shown here resulted when the rope was allowed to become rust-bound through lack of lubrication. Tests show that properly lubricated rope has up to 10 times the life expectancy of dry rope.

Crushed by a Tractor Cleat

The Sunday punch for this piece of wire rope was delivered by a tractor cleat—just one of many crushing injuries caused by rope being run over or banged into by hard, sharp objects. Even the toughest wire rope is no match for this kind of mistreatment.

After a Suicide Jump



This rope jumped out of sheave and was soon destroyed by pulling around the shaft. Actually it was a case of sudden slack which threw the rope out of the sheave.

Burned on a Frozen Sheave

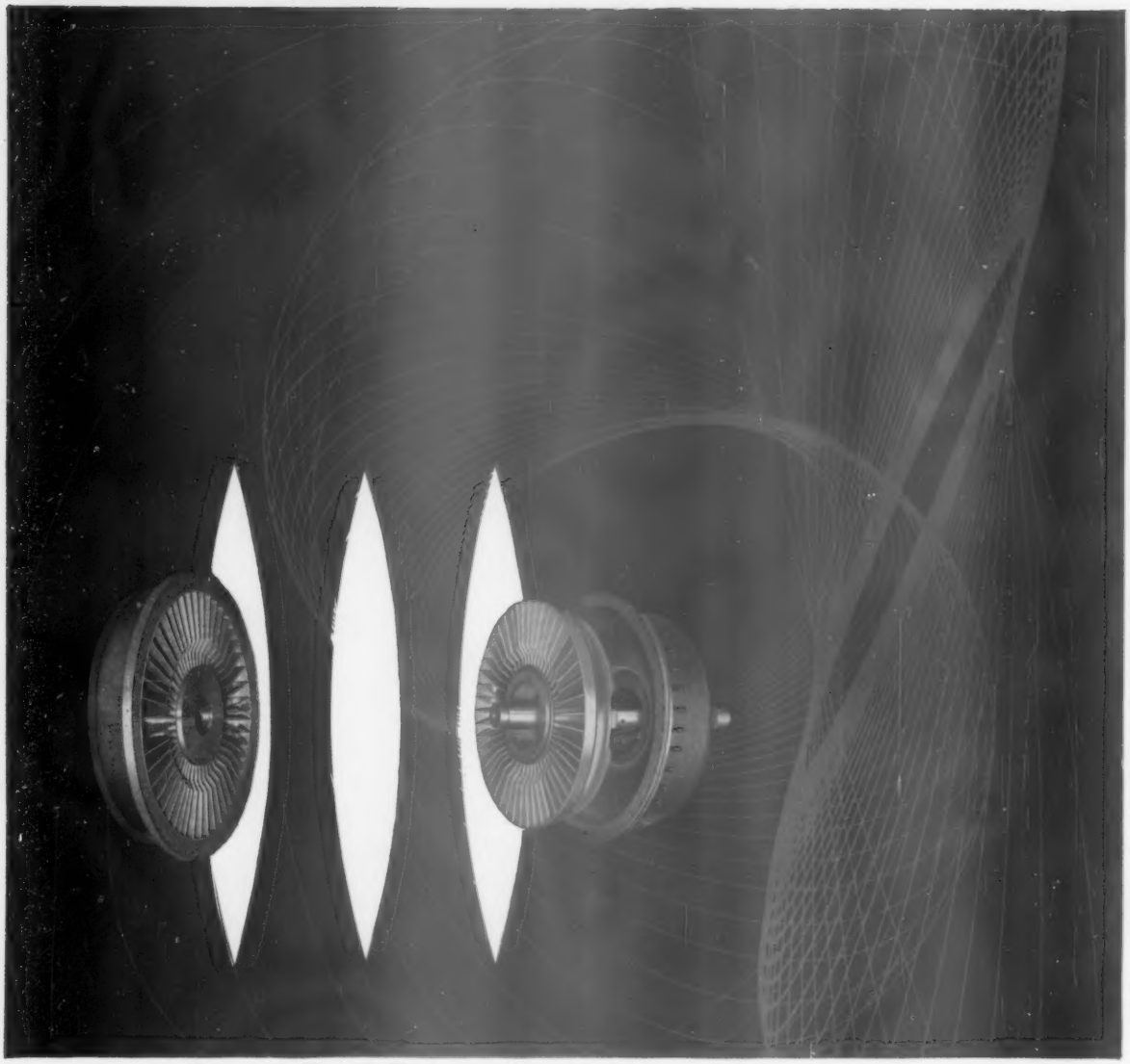
End of the line came quickly for this rope as the result of operating over a sheave that did not turn. Note the exceptionally heavy abrasion on one side of the rope. Sheaves should be checked thoroughly and often.

Would you like a copy of a booklet in which more than a score of Tuffy Tips like those above are reproduced. If so, write Union Wire Rope Corporation, 2102 Manchester Ave., Kansas City 26, Missouri.

UNION Wire Rope

Subsidiary of ARMCO STEEL CORPORATION

OTHER SUBSIDIARIES AND DIVISIONS: Armco Division • Sheffield Division • The National Supply Company
Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Southwest Steel Products



Gýrol® Fluid Drive gives you stepless, adjustable speed control... cushions shock

A vortex of oil is the secret of Gýrol Fluid Drive's smooth, stepless, adjustable-speed control. It protects driving and driven machinery from shock—with no belts, clutches, or sheaves to wear—no vacuum tubes, slip rings, brushes, or other electrical components to break or fail. No-load starting allows simplification of motors, starting equipment. And all units are easily adaptable to manual or automatic regulation. Ask a product specialist from our nearest office about Gýrol Fluid Drive. American-Standard* Industrial Division, Detroit 32, Michigan. In Canada: American-Standard Products (Canada) Ltd., Toronto, Ontario.

* American-Standard and Standard ® are trademarks of American Radiator & Standard Sanitary Corporation

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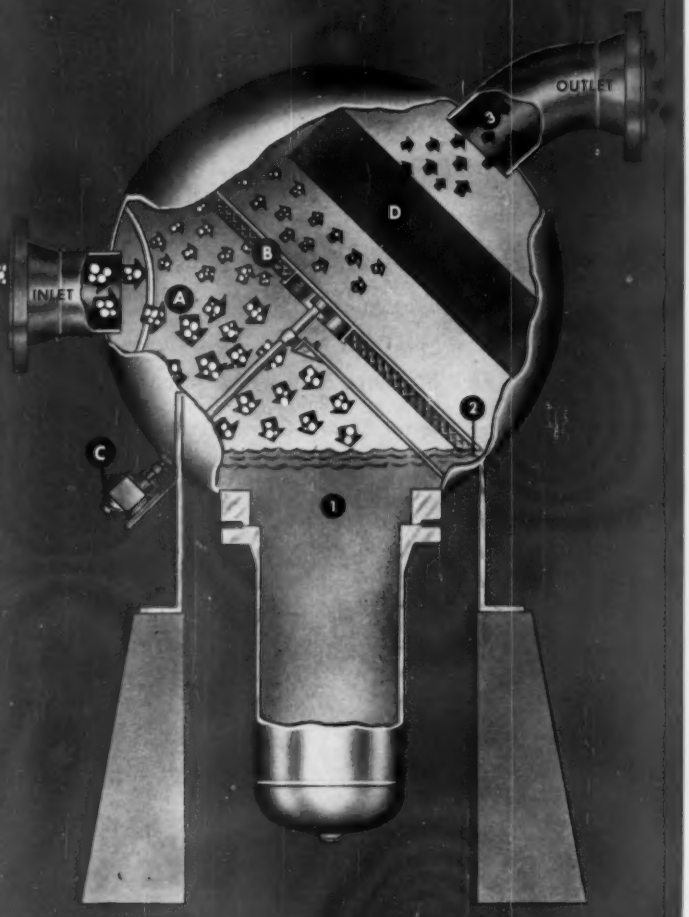
SCRUBOSPHERE* ...

... FOR *Cleaner Gas* AT *Less Cost!*



*PEERLESS SPHERICAL
DUST and LIQUID SCRUBBER
FOR GAS PIPELINES

LEGEND OF ABOVE CUTAWAY

The majority of incoming liquid (A) and solid particles are directed to either side and down into reservoir (1). Lighter solid particles carried by gas stream are separated on surfaces of contactor (B) which are kept wet and clean by revolving thru liquid reservoir (2). Contactor is revolved by explosion-proof gear motor (C). Mist Extractor (D) removes any remaining liquid particles from gas stream prior to outlet (3).

- The **dust removal ability** of the SCRUBOSPHERE **is superior** because it utilizes wetted surfaces for dust collection which are much more closely spaced than in conventional equipment.
- **Oil loss is minimized** because the oil used to wet the dust collecting surface is lifted mechanically instead of bubbling gas through the oil which results in foaming and loss due to creation of hard-to-separate fine particles.
- **Maximum performance and low cost** — The spherical design means high capacity and performance because it provides maximum dimensions for the contactor and mist extractor which normally are limiting factors in scrubber designs. The vessel cost is reduced because required vessel thickness is only one half that required for cylindrical vessel of same diameter.
- **Versatility** — separates solid and liquid particles with equal efficiency.
- **Low pressure drop** — ½ to ¾ psi at rated capacity depending on nozzle size.

PEERLESS MFG. CO. DALLAS, TEXAS

PEERLESS MANUFACTURING CO.

P. O. BOX 13165 DALLAS, TEXAS

Representatives in All Principal Cities

Write for test data showing dust removal and oil loss of Peerless Scrubosphere as against conventional dust scrubber.

OVER 20,000 SEPARATORS and SCRUBBERS IN SERVICE"

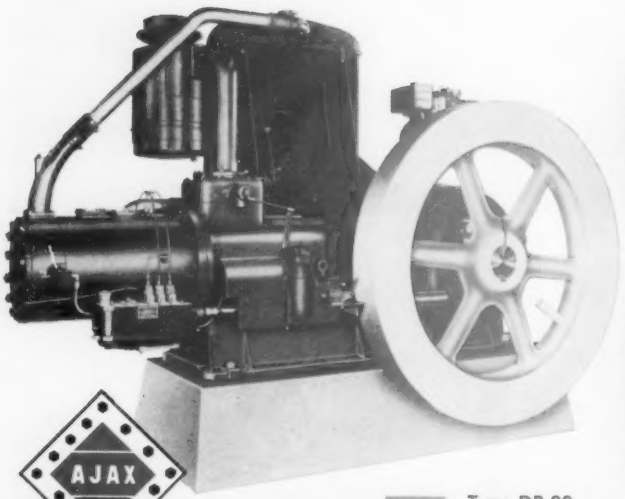
WHEN YOU INVEST IN AN AJAX PRODUCT YOU CAN BE CERTAIN IT HAS BEEN PROVED IN ENGINEERING AND PERFORMANCE. YOU ARE NOT A PART OF THE MANUFACTURER'S "EXPERIMENTAL" PROGRAM.

Shown below (left) one of the new DP-80 Ajax long service engines and on the right the TPBL TP-5000 Ajax pump, 5" stroke, Type TPBL 5375 rated at 112 HP . . .

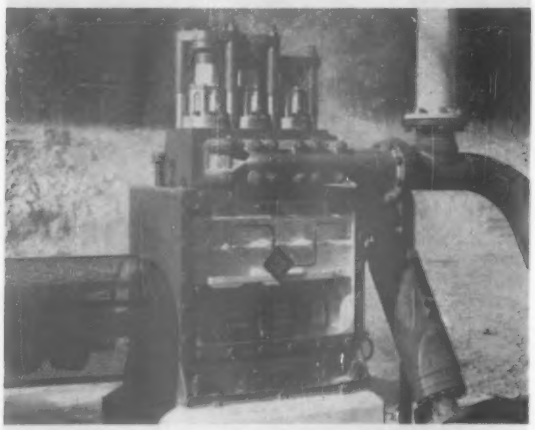
Send for the new brochure on the new Ajax Engines and Single Cylinder Engine-Compressors . . .

Now as always — a full dollar's proven value in every Ajax product — all ways.

Are you a "GUINEA PIG" Customer?

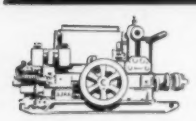


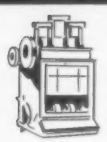
Type DP-80



TPBL-5375 Pump

ALWAYS A FULL DOLLAR'S VALUE IN AN AJAX PRODUCT





AJAX . . . also builders of COMPRESSORS —— PUMPS

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Oil Field Distributors

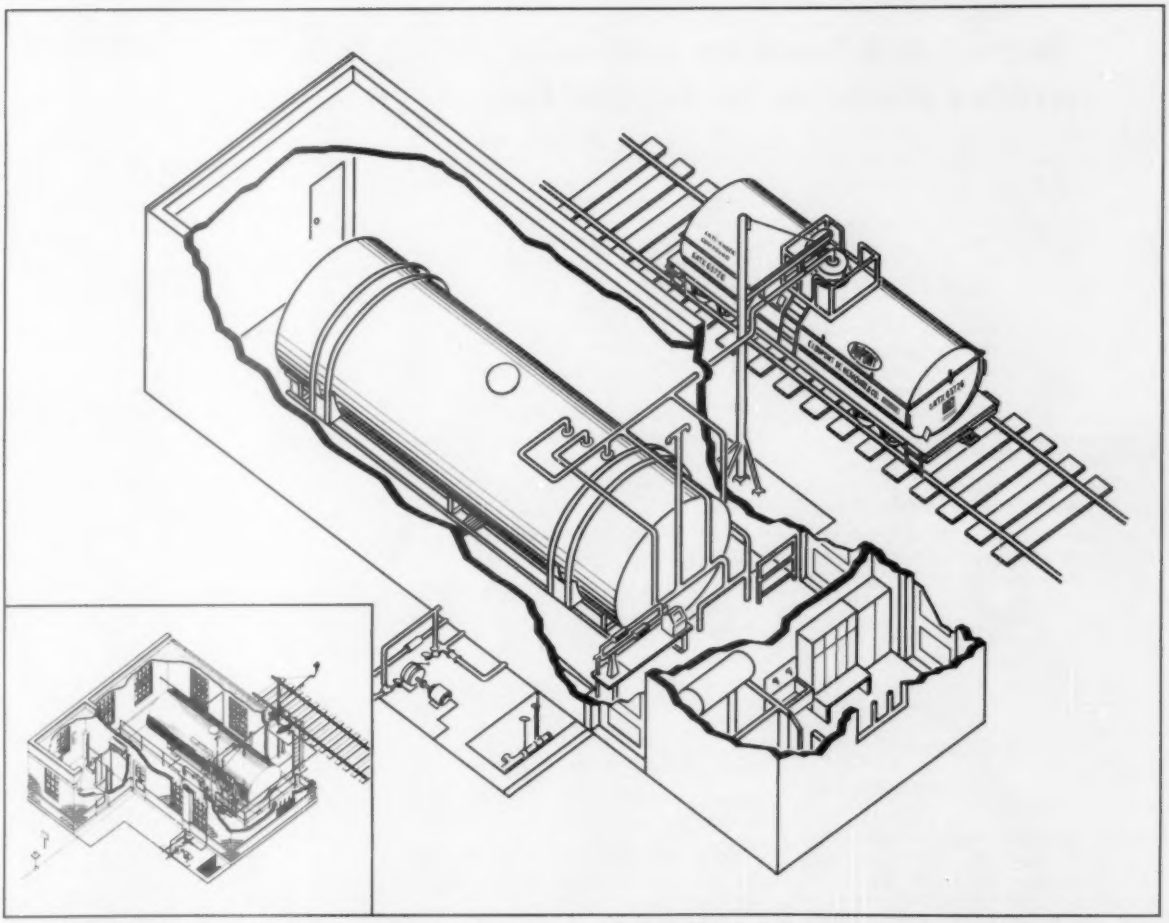
- The National Supply Co. — Pittsburgh, Pennsylvania
- Bethlehem Steel Co. — Supply Division, Tulsa, Oklahoma
- Mid-Continent Supply Co. — Fort Worth, Texas

DU PONT *Petroleum Chemicals* NEWS

Number 102 in a Series of Bulletins for the Petroleum Industry

MAY-JUNE 1960

New TEL blending plant design puts more efficiency into less space



NEW TETRAETHYL LEAD BLENDING PLANT represents a major design change made possible by Du Pont's continuing efforts to develop new methods for more efficient use of petroleum additives by refiners.

Du Pont design reduces unloading time, cuts construction and maintenance costs

Ever since Du Pont designed the first tank-car-to-weigh-tank tetraethyl lead blending plant in 1928, our continuing research programs have yielded many refinements in blending plant equipment and operation. Among them have been the metal-flex unloading hose, the siphon starter and hydraulic system modifications.

Du Pont engineers have now figuratively taken apart and redesigned the TEL blending plant from the ground up. Their goal was to develop a design that incorporates new engineering developments and materials.

They tested valves, fittings and components to determine their actual interrelations. They evaluated the relationship of tank car and weigh tank. They investigated construction costs. They accumulated mountains of facts and details.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DU PONT *Petroleum Chemicals* NEWS

Railroad learns what happens when it stops using FOA-2

Not long ago, a leading railroad tried an interesting experiment:

They had been using Du Pont FOA-2 to keep diesel locomotives free from filter plugging and other potential fuel problems. At one point, however, they felt that the sludge problem wasn't severe enough to justify continued use of the additive. So they discontinued use of FOA-2 in certain fuels, to measure its value.

Shortly after the test started several cases of fuel incompatibility were reported for the first time; filter plugging increased; and it was quickly found that the cost to replace the filters was more than the cost of the FOA-2 they had previously used.

Today, this railroad is once more using FOA-2 to reduce sludging and keep filters clear. Costs and maintenance and worries are once more back in line.

Du Pont AFA-1 provides economical corrosion protection for Aviation Fuels

Refiners are reminded of the very high effectiveness of Du Pont AFA-1 Aviation Fuel Additive as a corrosion inhibitor.

Concentrations as low as 2-4 pounds per 1,000 gallons have been found to produce rust inhibition in some fuels by the modified ASTM D665-54 Dynamic Rust Test.

Exact dosages, of course, depend upon the characteristics of the fuel itself. But the consistently low amounts of AFA-1 required can mean substantial savings in your additives costs. (Another advantage of AFA-1: the water tolerance test on aviation gasolines as jet fuels is more easily met.)

In addition to automotive and aviation gasolines, Du Pont AFA-1 brings the advantages of corrosion inhibition to other petroleum products such as heating oils and diesel fuels. Contact your Du Pont Petroleum Chemicals representative for additional information. Ask for our bulletin on Du Pont AFA-1.

CONTINUED

Plant redesign

Mathematical Model

From these data, a mathematical model was built which could be modified at will and examined by computers. The Univac then translated these models into actual blending plant designs. For any prospective design, for example, Univac could evaluate such data as specific gravity of the fluid, viscosity, barometric pressure and initial vacuum to determine unloading time. Optimum performance values were then established.

The result: an updated lead blending plant design that:

Reduces unloading time because every valve and fitting is operating at its known, optimum capacity. The operator's effort is reduced as well, since his work area is now at the *end* of weigh tank. Waste motion is eliminated.

Reduces construction costs through a more compact, modern design. The "straight-line" plant occupies less floor area, eliminates windows and the former "L" floor plan. With the weigh tank installed on the scale, several tons of structural steel supports are eliminated.

Reduces maintenance, for example, through a new ball valve design which provides for low pressure drop. This valve is equipped to minimize leakage and packing problems.

Full Details Available

Interested refiners can obtain full details on this new blending plant design by contacting the nearest Du Pont Petroleum Chemicals representative. His office is listed in the box below.

You ought to know

LEWIS Z. CAREY, manager of our Pittsburgh district office. He succeeded the late Afton D. Puckett in mid-1959.

A native Philadelphian and a graduate of the University of Delaware, Lew Carey first came to Du Pont in 1941 when he joined the Organic Chemicals Department. Later that year he began four years of military service as gunnery officer aboard a destroyer escort.

He returned to Du Pont late in 1945 and was a sales correspondent for our Alcohol and Camphor Division until 1951, when he joined the operations section of the Petroleum Chemicals Division as a technical assistant. Shortly afterward he became a sales service representative in our Eastern region, and then became the first manager of our Philadelphia district office in 1955. In that assignment, he was effective in serving the petroleum refiners and marketers in that area with the technical, marketing and refining know-how of Du Pont's Petroleum Chemicals Division.

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Better Things for Better Living
. . . through Chemistry

Du Pont Tetraethyl Lead and other Petroleum Additives

OVER

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A-14686

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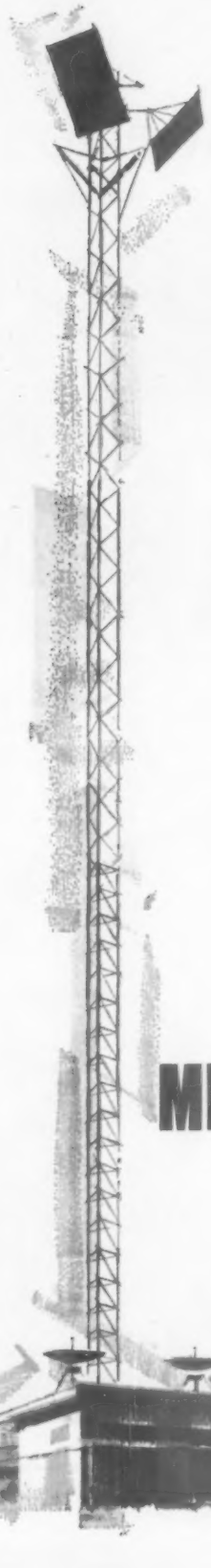
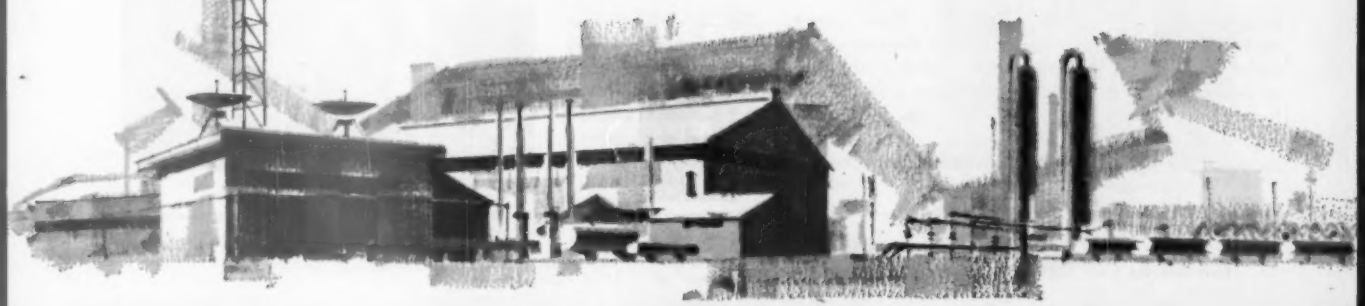


COLUMBIA GAS SYSTEM
plans 470 miles of Collins microwave . . .

COLLINS MICROWAVE AND CARRIER

United Fuel Gas Company, a subsidiary of The Columbia Gas System, Inc., has ordered the first section of a Collins microwave system. When completed it will span four states and provide this major natural gas utility with complete facilities for voice communication, teletypewriter service, telemetering, supervisory control and data communication. Expandable to 240 channels, the Collins microwave system will be a part of a broad automation program being planned by Columbia.

For information on a microwave-carrier system tailored to your individual needs, contact Collins Radio Company, Texas Division Sales, 1200 North Alma Rd., Richardson, Texas.

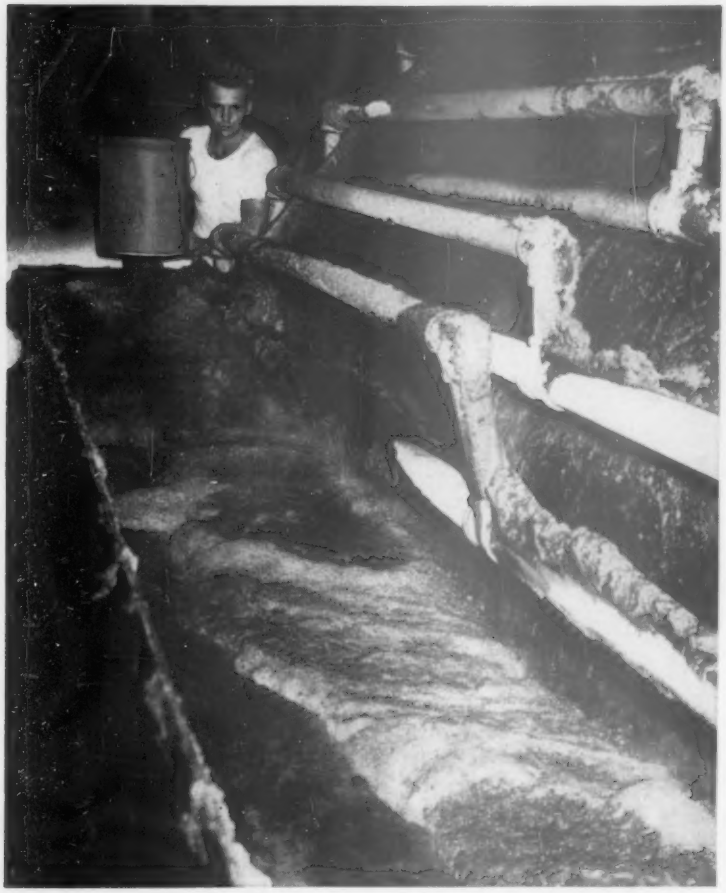


COLLINS

COLLINS RADIO COMPANY • DALLAS, TEXAS • CEDAR RAPIDS, IOWA • BURBANK, CALIFORNIA

SILICONE NEWS from Dow Corning

Down Foam and Up Production



IN PACKAGE DYEING

Job-Proved Dow Corning Silicone Defoamers Save Time, Material, Money

Foam may be fine in a brewery. But in most processing plants, it's a sign of inefficiency. Foam reduces production capacity, slows processing, increases waste — can skyrocket your costs way out of proportion. But why accept foam as a necessary evil when Dow Corning silicone defoamers are so readily available to knock out "bubble trouble" . . . quickly, easily and economically?

Imagine . . . just a few drops of a Dow Corning silicone defoamer is all it takes to control even the most violent and persistent foamers. And these versatile silicone defoamers neither alter nor contaminate products or processes. This permits you to use a Dow Corning defoamer wherever foam is a problem — in textile dyeing, papermaking and sizing; in refining, distilling and gas "scrubbing"; in food processing and packaging; in formulating paints, adhesives, pharmaceuticals . . . you name it.

No matter what you produce or process, you'll find Dow Corning silicone defoamers are economical; savings and production advantages are multiple. Prove this with your own tests using a generous trial sample that's yours for the asking. In writing for this free sample, please indicate your problem and mention the type of system—oil, aqueous, nonaqueous, food products, or any other. Address Dept. 2905 for a rapid reply.

IN REFINERY GAS SCRUBBING

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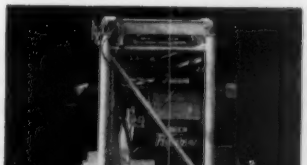

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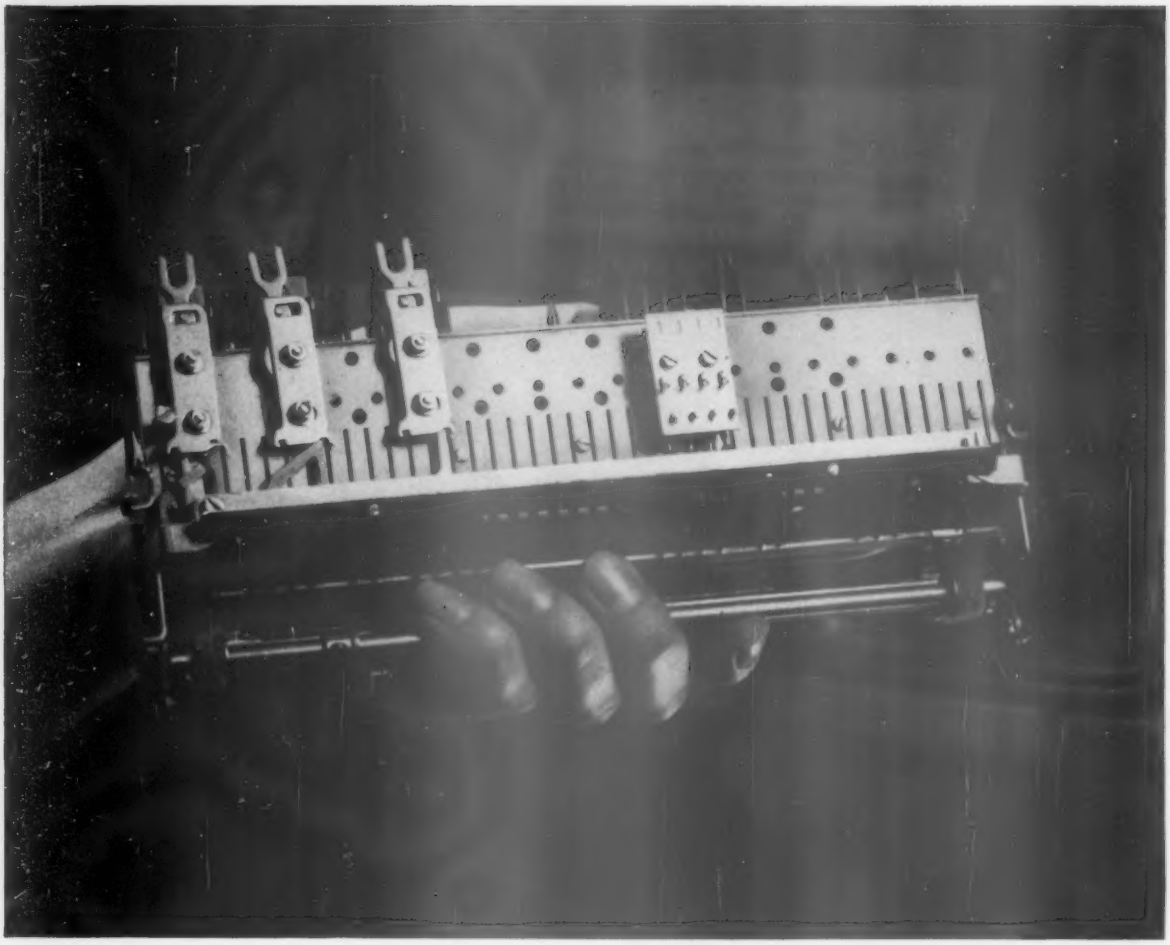

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Built into Teletype Model 28 page printers is a control device called the Stunt Box. The function of this unique component is to provide extra control facilities for both local and remote operations. Thus—in addition to transmitting, receiving and recording messages and data—the page printer can be used for a variety of switching, remote control and selective calling tasks.

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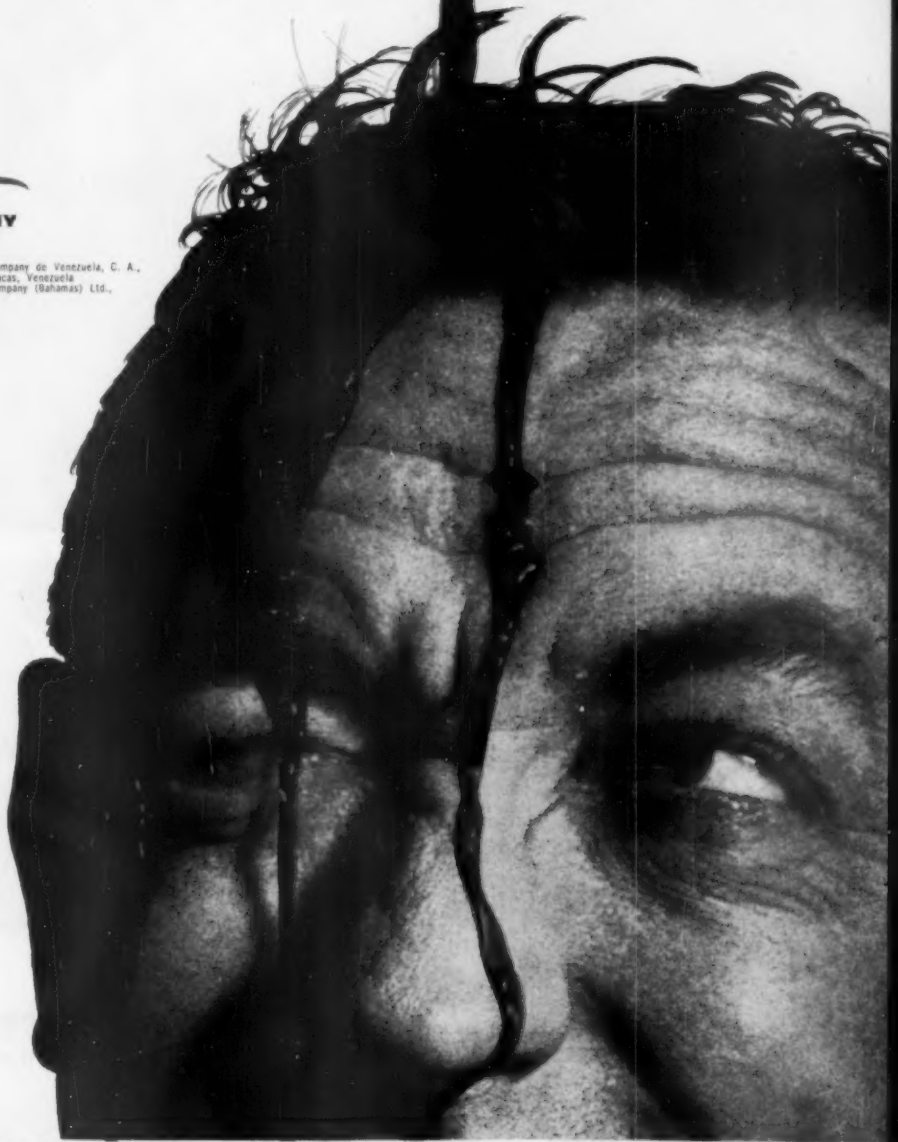

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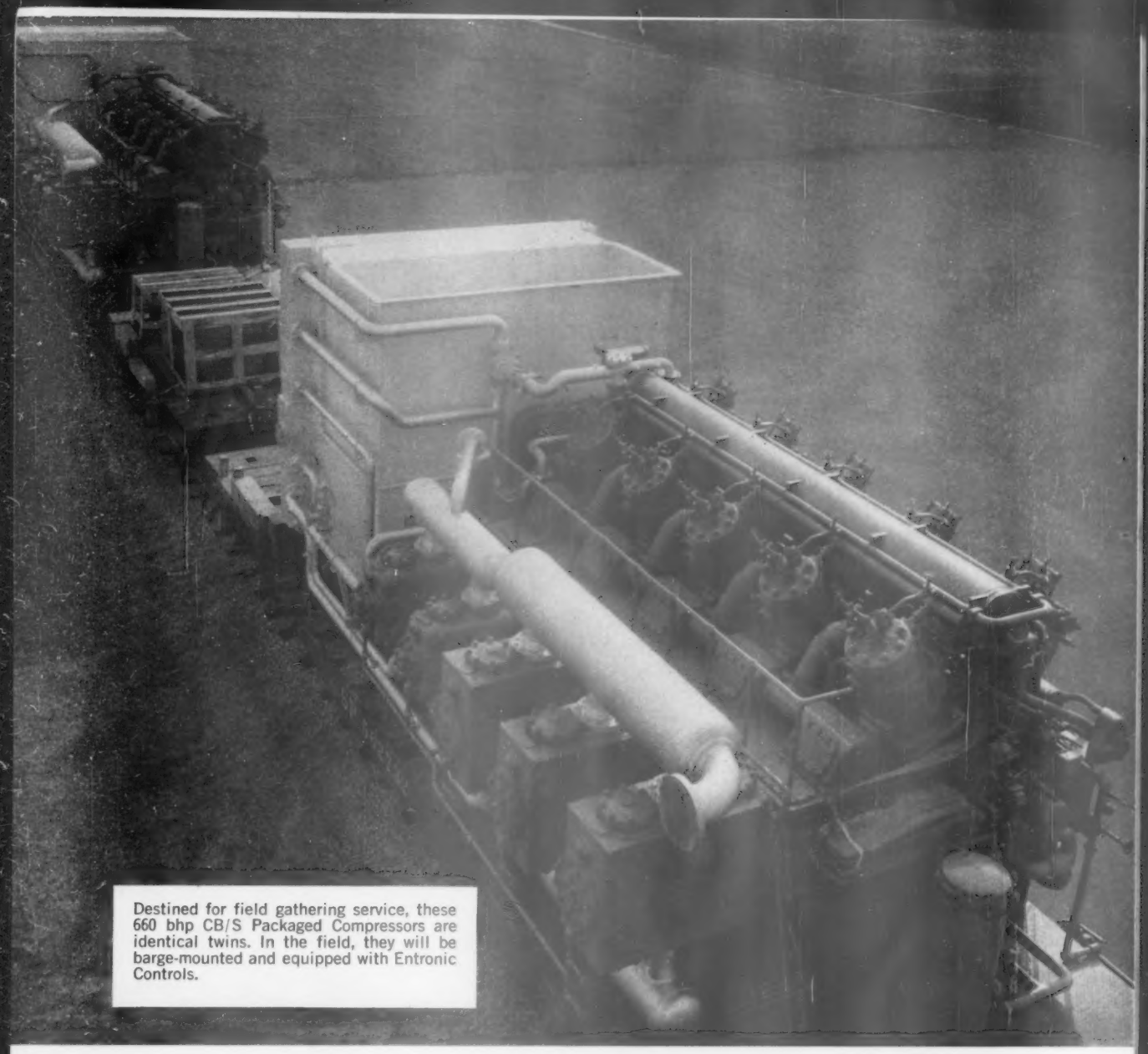

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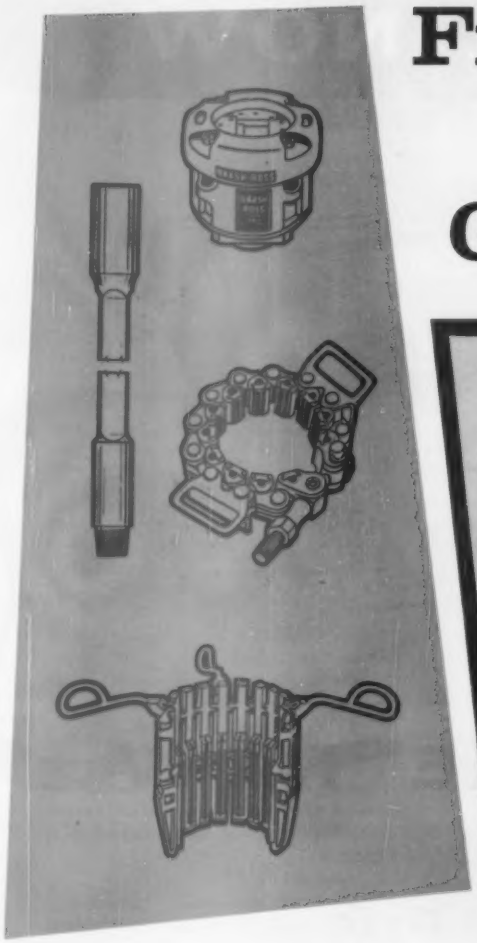

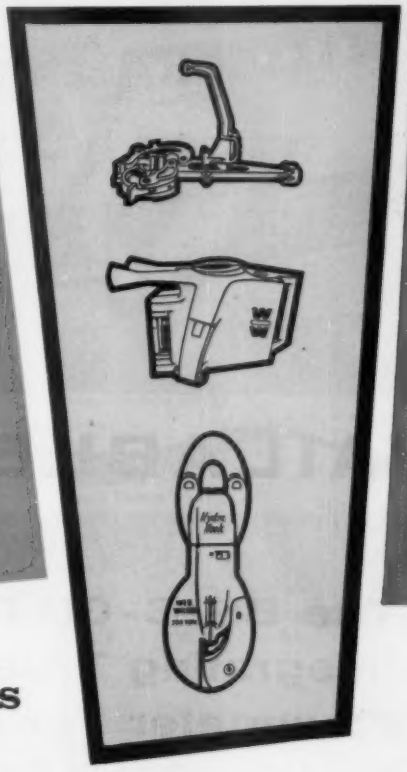

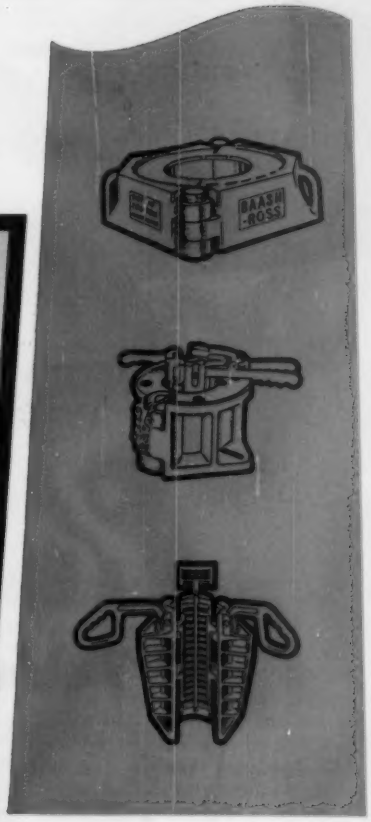

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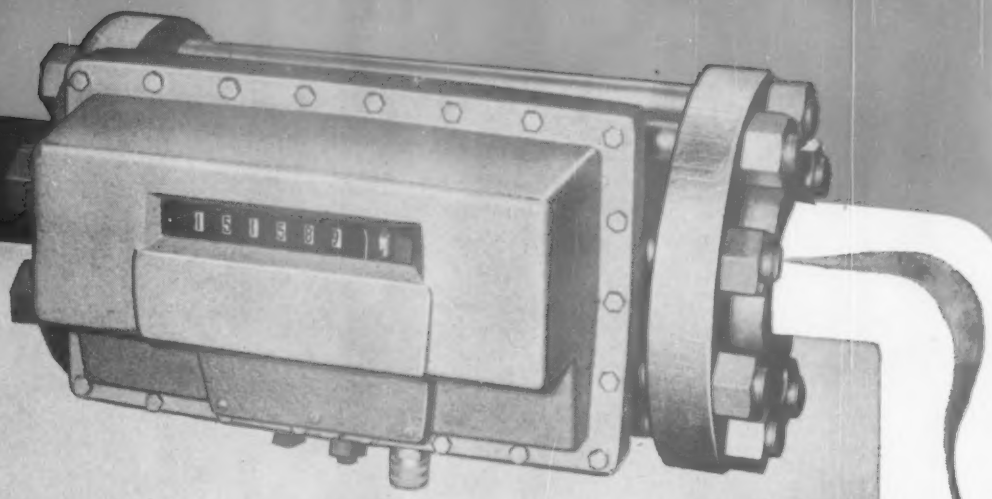

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Gives Accurate Gas Flow Measurement Under Wide Variation of Flow Rates, Pressures, Temperatures and Densities

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True Mass measurement eliminates the problems associated with varying gas densities, super-compressibilities and other physical properties. Measures directly and precisely the gas flow rate in pounds. Readily adapted to automation.

The BS&B Mass Flowmeter makes possible new economies at nearly every level of natural gas measurement. You get large savings not only from reduced calculating time but also from increased accuracy in gas accounting.

Gyro-integration in the meter eliminates chart handling and chart-integration by planimeter. The small, light, self-contained meter is ready for installation — no meter run is required. It's simple to operate and has long service life.

Get highest accuracy from this newest development in mass flow measurement. To prove this meter out for the natural gas industry, BS&B constructed a special prover facility which is believed to be the first positive prover for gases. For your specific application, write . . .

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They Say—

Kansas Conservation

Dear Sir:

It is good that a publication of your standing and perception can perform such a public service for the industry as this analysis (OGJ, April 11, "Kansas Is Ripe for New Oil Laws," p. 77, and OGJ, April 18, "Spacing Headaches Bedevil Kansas," p. 86, by Robert J. Enright).

I agree generally with your findings and know that Kansas operators and the Kansas Corporation Commission will find the articles useful and helpful.

F. F. Wright
Sinclair Oil & Gas Co.
Tulsa

Dear Sir:

Mr. Enright is a fine writer, but I doubt if he is qualified to tell the producers in Kansas what is good or bad for them.

In many cases producers are content to work out problems as best they can under old laws. When new laws are passed, court decisions do not always allow regulation to be administered as was originally intended.

Mr. Enright has taken the commission to task for almost everything they do, including, but not limited to, the method for establishing water-flood allowables, holding proration hearings, fees charged for various services, publication of proration schedules, etc.

Some of the procedures used here in Kansas can, and should, be changed, and some changes have been proposed to the commission. However, you must remember that our commission must depend on Kansas producers for the information upon which to base decisions and it is through the many hearings which they hold that this information becomes available.

If the intention of the article in your publication was to be of aid to the industry, then I think it has fallen short. It is easy to be critical, but very difficult to be diplomatic and helpful.

Lester Wilkonson
Petroleum Engineer
Wichita

Dear Sir:

Those of us here at Phillips who had the pleasure of discussing these matters with Bob Enright have read the articles and feel that Mr. Enright did an excellent job.

The work done by the Journal in

You save drilling dollars with a Baroid Mud Program

THE MUD PROBLEM AND ITS SOLUTION

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When the problem is selecting an oil-base emulsion mud to protect formations against water damage, INVERMUL is the answer. INVERMUL invert emulsion mud prevents water damage to formations, is easy to make up and maintain and has high tolerance against contaminating water base mud.

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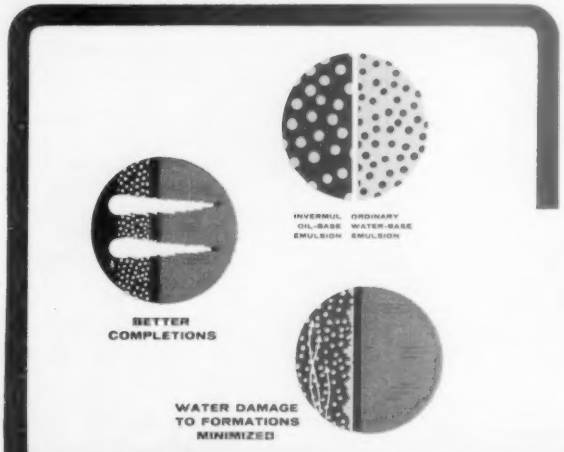

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calling to the attention of the industry and the various oil and gas-regulatory bodies the need for improvement is, we believe, most timely. I am sure that these articles will help the industry to obtain the modernized conservation statute which is so much needed in the State of Kansas.

O. P. Nicola, Jr.
Phillips Petroleum Co.
Bartlesville, Okla.

Dear Sir:

Your articles on what's wrong in Kansas raised some temperatures and bottom-hole pressures in our Oil and Gas Conservation Division for failure to credit us with considerable progress in spite of cumbersome statutes.

I thank you, though, for the constructive criticism. Some of it parallels the recommendations in our 1958 annual report of the Kansas Corporation Commission to the Kansas Legislature.

Marion Beatty, Commissioner
(former chairman)
Kansas Corporation Commission

Dear Sir:

I am sure that any oil man in Kansas was well within his rights to take exception to Mr. Enright's article. It failed to give any credit at all to the progress made in Kansas by our Conservation Commission.

His article was unnecessarily critical of the fact that Kansas does not have forced pooling laws, nor yet has a law providing for integration of leases. As long as the minimum well allowable, which is 25 bbl., has been in force in Kansas and has been such a stabilizing factor on the oil industry in Kansas, I think his remarks afforded a disservice rather than a critical approach.

Paul B. Shivel
Vice President, Production
Petroleum, Inc.
Wichita

Dear Sir:

. . . I believe that Bob Enright has done an excellent job of pointing up some of the problems involved in Kansas proration.

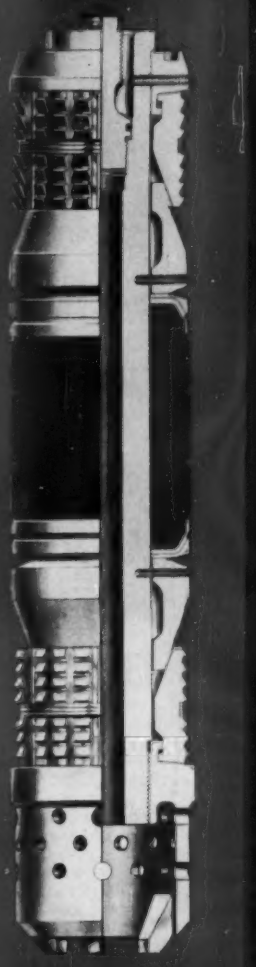
William R. Loar
Chief Proration Engineer
Sunray Mid-Continent Oil Co.
Tulsa

Dear Sir:

The 25-bbl. minimum is the basis of much of your criticism. The Kansas legislature feels that with so many oil wells in Kansas the 25-bbl. minimum is necessary for the Kansas economy.

Your articles do not reflect the viewpoint of the independent pro-

Short, compact, less to drill up



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Small O.D. offers ease of running.

Can be set with any pressure setting tool.

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AVAILABLE FROM ALL ELECTRIC LINE SERVICE COMPANIES — STOCKED AT 247 FIELD LOCATIONS. Not only are Otis Wire Line Bridge Plugs available through any electric line service company, but stocks are maintained at 247 different field storage locations so that you can set an Otis plug whenever you need it — wherever you need it. And Otis bridge plugs can be set on any type of pressure setting tool. So the next time you need a bridge plug to prevent movement of fluid or gas from either direction in the casing, or to plug and abandon — play it safe — specify an Otis Wire Line Bridge Plug.

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You protect yourself and your pipe when you specify Plasticap HTP. More Plasticap is used in oilfield pipe than any other coating!

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ducer. There are few evils in our allowable systems that an increased market would not cure. Our commission has taken long strides in its field rules in encouraging wider spacing.

Jewel Ogden, Director
John P. Roberts,
Assistant Director
Conservation Division
Kansas Corporation Commission

Dear Sir:

I would like to compliment Mr. Enright on the thoroughness of his articles. It seems to me that he has pretty well covered the problem and adequately pointed out that new laws are necessary, as well as a change in commission rules.

Such objective analysis it would seem can only lead to improvement.

James H. McGowan
Sinclair Oil & Gas Co.
Tulsa

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

MAY

16-17 International Society of Professional Well Log Analysts, first annual meeting, Tulsa Hotel, Tulsa.

18-20 American Petroleum Institute, Division of Marketing, midyear meeting, Statler-Hilton Hotel, Cleveland.

22 Pennsylvania State University, short course in reservoir engineering, University Park, Pa. Term ends June 10.

22-25 National Association of Purchasing Agents, annual convention, Biltmore Hotel, Los Angeles.

22-26 Air Pollution Control Association, annual meeting, Netherland-Hilton Hotel, Cincinnati.

23-24 American Gas Association, production meeting, Roosevelt Hotel, New York City.

23-26 American Society of Mechanical Engineers, oil and gas power conference and exhibit, Muehlebach Hotel, Kansas City.

24 American Right of Way Association, pipeline right of way section, meeting, Shoreham Hotel, Washington.

24-25 Western Petroleum Refiners Association, computer conference, Ben Milam Hotel, Houston.

24-26 American Right of Way Association, annual seminar, Shoreham Hotel, Washington.

25-27 Pacific Coast Gas Association, accident prevention and transmission conference, Hotel Utah, Salt Lake City.

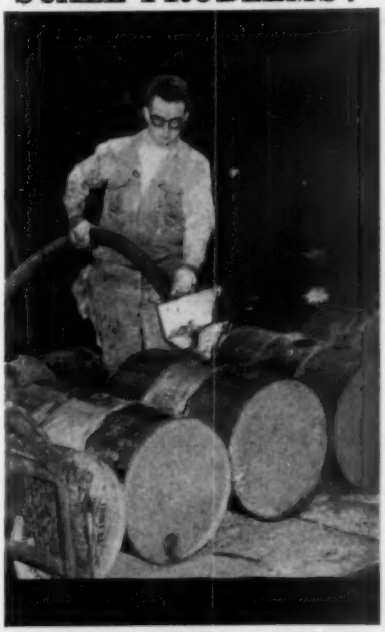
26-27 Natural Gas and Petroleum Association of Canada, meeting, Niagara Falls, Ont.

25-28 American Association of Petroleum Geologists, western Canada regional meeting, Banff Springs Hotel, Banff, Alta.

JUNE

1-3 Texas College of Arts and Industries, fifteenth annual short course on gas technology, sponsored by

SCALE PROBLEMS?



INHIBITED ACID

Bulk Inhibited Hydrochloric Acid has many uses to help solve both maintenance and production problems. For instance, Dowell Inhibited Acid is useful for cleaning scale and gyp from producing formation, tubing and lead lines; cleaning scale from piping, valves, fittings and nipples; dump-job treatments in old dolomite or limestone wells. Particularly suited to do-it-yourself treatments. Available in bulk lots at all Dowell stations. Economical.

Products for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

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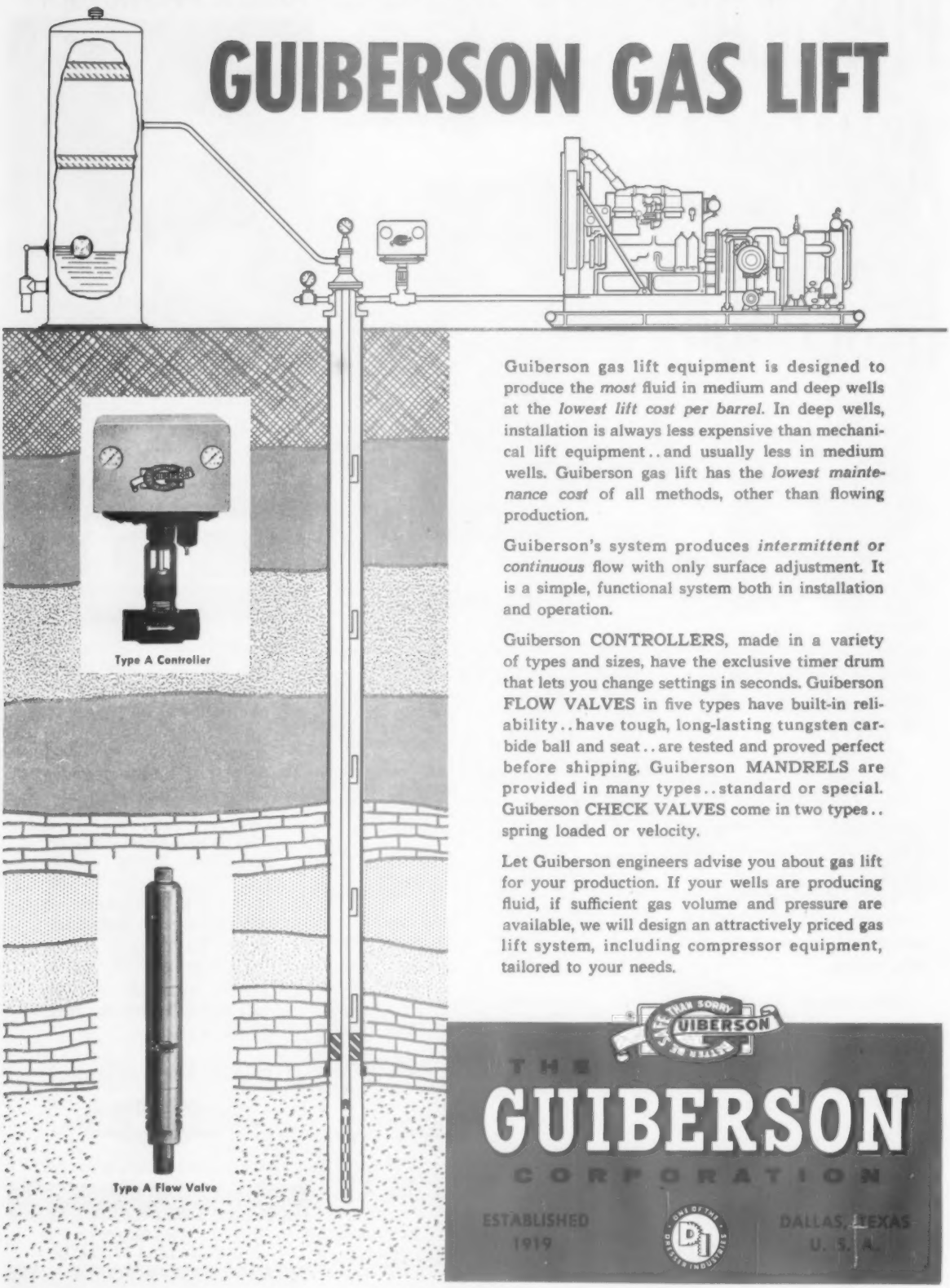
When Flow Is Slow.. It's Time For

GUIBERSON GAS LIFT



Guiberson gas lift equipment is designed to produce the *most* fluid in medium and deep wells at the *lowest lift cost per barrel.* In deep wells, installation is always less expensive than mechanical lift equipment.. and usually less in medium wells. Guiberson gas lift has the *lowest maintenance cost* of all methods, other than flowing production.

Guiberson's system produces *intermittent or continuous* flow with only surface adjustment. It is a simple, functional system both in installation and operation.

Guiberson CONTROLLERS, made in a variety of types and sizes, have the exclusive timer drum that lets you change settings in seconds. Guiberson FLOW VALVES in five types have built-in reliability.. have tough, long-lasting tungsten carbide ball and seat.. are tested and proved perfect before shipping. Guiberson MANDRELS are provided in many types.. standard or special. Guiberson CHECK VALVES come in two types.. spring loaded or velocity.

Let Guiberson engineers advise you about gas lift for your production. If your wells are producing fluid, if sufficient gas volume and pressure are available, we will design an attractively priced gas lift system, including compressor equipment, tailored to your needs.

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Southern Gas Association, Kingsville, Tex.

1-3 West Virginia University, fifth annual Appalachian underground corrosion short course, Morgantown, W. Va.

2 Pennsylvania Grade Crude Oil Association, annual meeting, Pennhills Club, Bradford, Pa.

2-3 Kentucky Oil and Gas Association, annual meeting, Phoenix Hotel, Lexington.

5-9 American Society of Mechanical Engineers, summer annual meeting, Dallas.

5-10 Society of Automotive Engineers, summer meeting, Edgewater Beach Hotel, Chicago.

9-11 Manufacturing Chemists' Association, annual meeting, The Greenbrier, White Sulphur Springs, W. Va.

13-15 American Association of Cost Engineers, annual meeting, Rice Hotel, Houston.

13-15 Chemical Institute of Canada, annual conference and exhibition, Chateau Laurier, Ottawa.

13-15 Interstate Oil Compact Commission, midyear meeting, Statler Hilton Hotel, Detroit.

15-16 Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Hotel Lassen, Wichita.

19-22 American Institute of Chemical Engineers, Instituto Mexicano de Ingenieros Quimicos, joint meeting, Hotel Del Prado, Mexico City.

22-25 Canadian Gas Association, annual meeting, Manoir Richelieu, Murray Bay, Quebec.

22-25 American Association of Petroleum Landmen, national convention, Ambassador Hotel, Los Angeles.

25-29 Petroleum Equipment Suppliers Association, annual meeting, Banff Springs Hotel, Banff, Alta.

25-July 5 First International Congress for Automatic Control, Moscow, U.S.S.R.

26-28 North American Gasoline Tax Conference, annual meeting, southern region, Eden Roc Hotel, Miami Beach.

26-July 1 American Society for Testing Materials, annual meeting and exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J.

27-28 Michigan Gas Association, Mackinac Island, Mich.

JULY

18-29 Massachusetts Institute of Technology, dynamics and control of chemical engineering processes program, Cambridge, Mass.

28-30 American Petroleum Institute, Division of Production, Eastern district meeting, The Greenbrier, White Sulphur Springs, W. Va.

AUGUST

3-5 Wyoming Geological Association, field trip to Snyder basin and Wind River Mountains, Casper.

14-19 National Congress of Petroleum Retailers, Inc., annual session, Shamrock-Hilton Hotel, Houston.

15-17 American Society of Mechanical Engineers, American Institute of Chemical Engineers, heat transfer conference and exhibit, Statler Hilton Hotel, Buffalo, N. Y.

15-26 Sacramento State College, summer institute on nondestructive testing, Sacramento, Calif.

22-26 Gordon Research Conference, catalysis, Colby Junior College, New London, N. H.

29-31 Appalachian Gas Measurement Short

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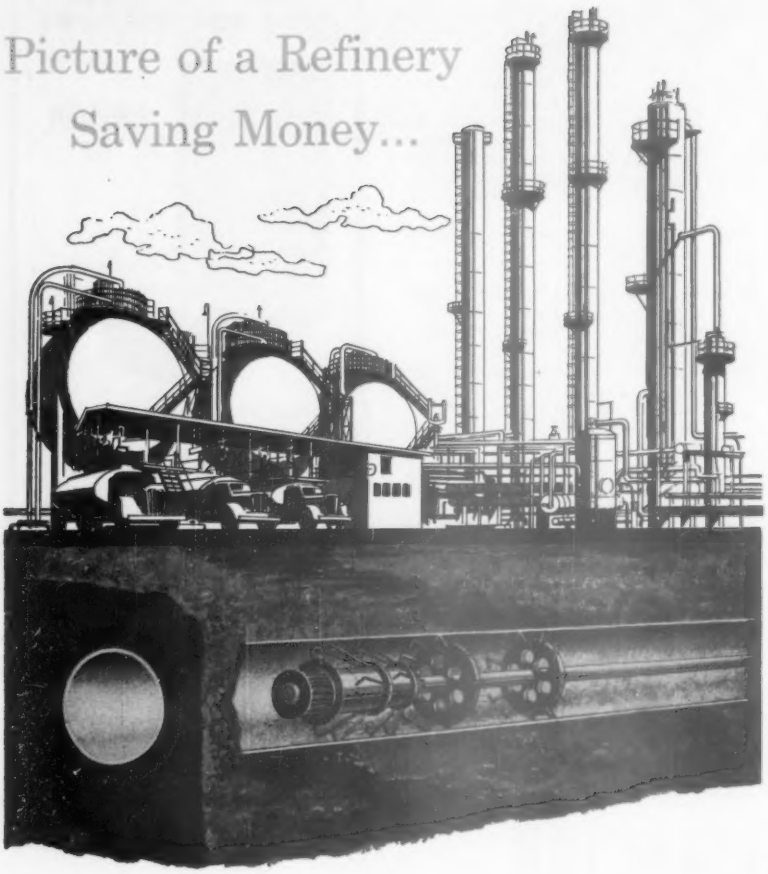

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Rail Address, Pacific Electric, Watson, California

Course, University of West Virginia, Morgantown, W. Va.

30-Sept. 2 American Association for the Advancement of Science, Alaska Division, eleventh Alaskan science conference, Anchorage.

SEPTEMBER

6-7 Chemical Institute of Canada, organic chemistry division conference, Edmonton.

7-9 American Society of Mechanical Engineers, joint automatic control conference, Massachusetts Institute of Technology, Cambridge, Mass.

8-9 National Research Council, Chemical Institute of Canada, tenth Canadian high polymer forum, Alpine Inn, Montreal.

8-9 Mid-Continent Oil and Gas Association, Louisiana - Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

8-10 Chemical Institute of Canada, western regional conference, Regina.

8-10 Intermountain Association of Petroleum Geologists and Eastern Nevada Geological Society, field trip, economic geology of east-central Nevada.

11-16 American Chemical Society, national meeting, New York City.

14-15 Western Petroleum Refiners Association, Rocky Mountain regional technical - industrial relations meeting, Henning Hotel, Casper, Wyo.

14-16 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

15 Natural Gasoline Association of America, Rocky Mountain regional meeting, Palliser Hotel, Calgary.

18-21 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Jung Hotel, New Orleans.

19-21 Texas Mid-Continent Oil and Gas Association, annual meeting, Hilton Hotel, San Antonio, Tex.

21-23 Pacific Coast Gas Association, annual meeting, Westward Ho Hotel, Phoenix.

23 Oklahoma Utilities Association, gas division meeting, Biltmore Hotel, Oklahoma City.

25-27 American Association of Oilwell Drilling Contractors, annual meeting, Roosevelt Hotel, New Orleans.

25-28 American Institute of Chemical Engineers, meeting, Mayo Hotel, Tulsa.

25-28 American Institute of Electrical Engineers, petroleum industry committee, electrical conference of the petroleum industry, Hotel Skirvin, Oklahoma City.

26-30 Instrument Society of America, instrument-automation conference and exhibit, and fifteenth annual meeting, Coliseum, New York.

29-30 Mid-Continent Oil and Gas Association, Mississippi-Alabama division meeting, Grand Hotel, Point Clear, Ala.

OCTOBER

2-5 Society of Petroleum Engineers of AIME, annual fall meeting, Denver.

3-4 Independent Natural Gas Association of America, annual meeting, Fontainebleau Hotel, Miami Beach.

5-7 Four Corners Geological Society, third field conference, registration, October 4, Moab, Utah.

6-7 National Association of Corrosion Engineers, annual western region conference, Sheraton-Palace Hotel, San Francisco.

new analysis shows how to-

cut drilling costs by $200 per day

If you are using mud as heavy as 12 lbs. per gallon, here is an engineering analysis that shows how you can cut mud costs by using a CLAYJECTOR®.

12-pound mud generally contains about 1½ sacks of barite per barrel. Every time you jet a barrel of mud, you lose barite as well as the clays you are trying to get rid of. This means a monetary loss of over $3.50 per barrel.

Now, if you use three steel tanks, you lose about 100 barrels of mud every time you jet down one foot. Since it is common practice with muds in the 12-pound range, to jet at least one foot per day, that means you jet away something like $400.00 worth of barite, oil and chemicals. With heavier muds, there will probably be less jetting. However, the greater amount of barite and chemicals per barrel means an even greater loss by jetting. You can avoid that loss if you use the CLAYJECTOR to process your mud — rejecting unwanted clays and retaining expensive barite.

Since you get more than 70 per cent clay rejection efficiency with the CLAYJECTOR, you need process only 140 barrels of mud to reject the equivalent of all the clay from about 100 barrels of mud. This low volume of fluid processed keeps oil and chemical losses at a minimum.

Because barite recovery efficiency is 80 to 90 per cent, you lose less than one fifth of the barite in the mud being processed — a negligible amount out of the whole system.

To summarize, you save over $300 for every 100 barrels of mud you would have jetted — if you use the CLAYJECTOR instead of jetting. *Even when you deduct the cost of the CLAYJECTOR, you still can save well over $200 per day.*

This example may not apply precisely to your conditions, but your nearby Swaco sales engineer is ready to help you estimate your probable saving. Call him for more information.

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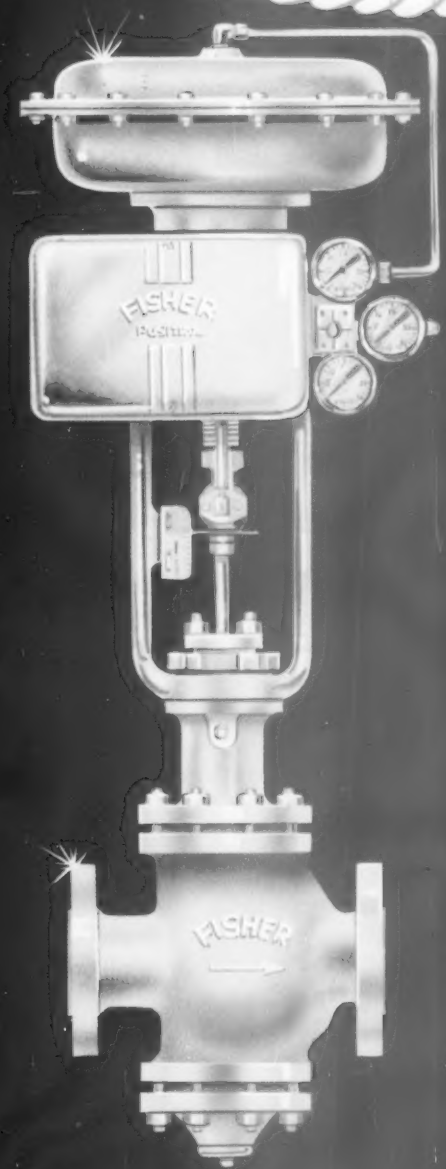

why you
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FISHER CONTROL VALVES
24 hours a day
–every day. . .

. . . *could increase the value of a* FISHER DMV!

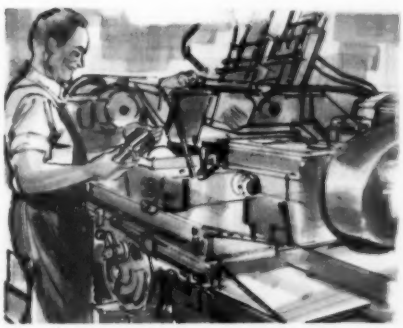
Why? Simply because the *real* value of Fisher diaphragm motor valves lies, not in metal and fiber and paint. It lies in practical design, improved manufacturing techniques, rigid inspection and a field organization second to none.

These are the factors that represent your real assurance of trouble-free performance in Fisher control equipment. They are also the factors that have made Fisher control valves the standard throughout industry for nearly half a century.

Next time you need control valves give the Fisher/Man a call. He's conveniently located for service and you'll find he has what you want . . . and where you want it . . . in a hurry.

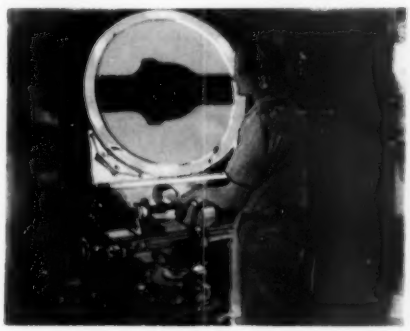
PRACTICAL DESIGN ENGINEERING

Design Engineering at Fisher is always aimed at solving industry's flow control problems in a practical and efficient manner. Continuous improvement for more than 50 years has resulted in a series of Fisher Diaphragm Motor Valves of proven durability and performance.



LATEST PRODUCTION METHODS

This machine, the latest in precision grinders, produces a super-finish on all valve guides and bushings. It is just one example of combining modern machine tools and the skill of experienced Fisher craftsmen to assure accuracy of control and long, trouble-free field operation.



RIGID INSPECTION PROCEDURES

Fisher's ratio of inspection personnel to production personnel has always been considered highest in the industry. This makes possible Fisher's rigid inspection policies. For example, no less than 704 inspection operations are performed on a 4" Type 657A control valve.

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD . . . CHANCES ARE IT'S CONTROLLED BY . . .

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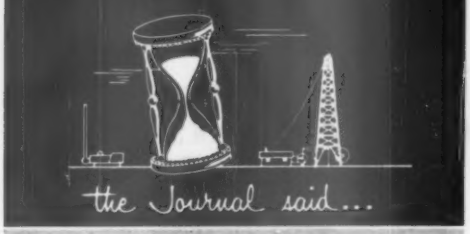


50 years ago

May 6, 1910

The deeper producing horizon recently opened by International Oil & Gas Co. in the Robinson shallow oil area of Lawrence County, Illinois, has been designated officially as the McClosky sand after the farm (William McClosky heirs) on which the discovery well was drilled. The sand, at 1,800 ft. shows promise of becoming a major producing horizon in the Robinson area and may extend to other fields of Illnois and adjoining states. Wells in the sand start off at 1,500 to 2,400 bbl. of oil daily.

Union Oil Co.'s Bastanchury, claimed to be the world's deepest producing well, comes in flowing 150 bbl. of oil daily through 1-in. flowline from depth of 4,444 ft. Located inside city limits of Fullerton, Calif., it is 4 miles from the field of that name. Completion ends 3½ years of formational and mechanical difficulties that have plagued drilling of the well.

25 years ago

May 9, 1935

K. S. Adams, assistant to the president of Phillips Petroleum Co., at Bartlesville, Okla., has been advanced to the office of treasurer and made a member of the board of directors.

Venezuela Gulf Oil Co., operating unit of Gulf Oil Corp., acquires 1,000,000 acres in oil concessions in eastern Venezuela in this country's largest oil transaction in 3 years. The purchase was from Orinoco Oilfields, Ltd., and Alfred Meyer interests, of London, England, for a reported price of $4,000,000. It is a sector of the country where Gulf has been carrying on extensive wildcatting for 2 years, and foretells a wider exploration program.

10 years ago

May 11, 1950

First thorough test of Nevada's oil potentialities begins with the announcement by Continental Oil Co. and Standard Oil Co. of California of a 7,500-ft. Silurian wildcat to be drilled jointly in White Pine County, in the northeast corner of the state. Their location, at 1 Meridian Unit, is 45 miles west of Ely. It is the first test to be drilled by any major company. Deepest test so far stopped at 2,845 ft.

A new offshore oil discovery in the Gulf of Mexico off the southeast tip of Louisiana in Block 24, South Pass Area, gives indication of opening one of the state's largest multiple-pay fields, embracing both offshore and close onshore areas. Discovery well, Shell Oil Co. 1 State Lease 1008, flows 49 bbl. of 22.7°-gravity oil daily through 11/64-in. choke from sand at 6,530-34 ft.

JOURNALLY SPEAKING

Ghost of 1935

WHAT DO YOU THINK of this statement, you oil and gas producers and industry lawyers?:

"When an interstate pipeline is connected to a natural-gas well all the gas in the underground reservoir of that field is in interstate commerce . . . (and) prevention of waste and conservation of the natural pressure of gas are regulations of interstate commerce subject to the jurisdiction of the federal Government."

That is a quotation from a news story appearing in The Oil and Gas Journal of April 11, 1935, page 14—25 years ago.

The statement was attributed to Dr. Walter M. W. Splawn, a member of the Interstate Commerce Commission. Commissioner Splawn was the ICC's expert on pipelines, and authored a number of articles on pipelines for the Journal in those days.

Dr. Splawn was also a distinguished educator (we ourself took graduate courses in economics and federal regulation of business under him). And he had been on the job of regulating business a good many years before Franklin D. Roosevelt's Brain Trusters hit Washington with their ideas of federal control of practically everything.

So he wasn't spouting through his hat when he made that statement. It appeared in a report he made to a congressional committee considering what became the Public Utility Holding Company Act.

Dr. Splawn went on to say that if the individual states properly conserve gas supplies it will not be necessary for the federal Government to exercise its authority over production.

In reporting this, the Journal's Washington editor added that Dr. Splawn's opinion applied equally to oil production and conservation, and then he went on to say that Washington observers felt that if Congress should ever attempt to stretch its authority to the point of federal regulation of oil and gas, "there is no question but that the courts would hold such provisions of any law unconstitutional."

Well, let's see how right those Washington observers were. That was 1935. Three years later Congress passed the Natural Gas Act of 1938. Congress did not attempt to exert the authority Dr. Splawn said it had to regulate gas production. Instead, Congress expressly stated that the act did not apply to production and gathering.

So what did the Supreme Court do? In 1946 it ruled that the act did apply to production. Those 1935 guessers were just 100% wrong on all counts.

So today nobody need be cock-sure in the belief that the courts would slap down Congress if it ever attempted to take oil and gas conservation regulation away from the states.

Would Congress ever try to control production and conservation? Well, it almost did a quarter-century ago. Not in connection with the holding-company bill that Dr. Splawn was testifying on, but on several other occasions.

Old-timers may recall this sequence of events: There was a depression on; East Texas and several other big flush pools were producing wide open; the price of crude dropped to practically nothing; no state had an adequate conservation law. In 1932 there was a strong movement to get approval of an interstate oil compact with teeth in it, but the API said it wouldn't work and voted to ask federal control instead.

In 1933 the New Deal took office and enacted the NRA, and its oil code provided federal regulation of production for 2 years. In 1934 Interior Secretary Ickes proposed federal control of conservation, and the Cole committee of Congress held lengthy hearings on his bill.

In 1935 the Cole committee said that the states should have a chance to see if they could control oil production before further consideration of federal regulation. So the present Interstate Oil Compact Commission was formed and several states adopted conservation laws.

Now it's 1960. The federal Government is regulating oil imports to make the domestic oil industry healthy. But the industry isn't healthy and some people put the blame on failure of the states to do an adequate job of regulation.

Wonder what Dr. Splawn, Harold Ickes, the Cole committee, and the Supreme Court would say about federal regulation of oil and gas production today.

—Henry D. Ralph.

Baker's New Snap-Set Duals

—the packers that are bringing single-zone control and simplicity to dual completions

A Baker dual-string completion approaches the control and simplicity (and the flexibility) of a single-zone completion. What makes this possible? Mainly the development of better upper retrievable packers—Baker's new Snap-Set Dual Packers. Operators all across the country are commenting on their impressive performance.

What makes a good dual-string packer? Several things, starting with the ability to (a) set and unset readily and repeatedly; (b) pack off and retrieve easily; (c) hold a dependable packoff even when pressures and temperatures are high.

Do Baker's new dual packers do these things? They do. This is easy to understand when you consider Baker's vast experience with high performance retrievable squeeze packers. The Baker Full-Bore Cementer, for instance, has seen action in thousands of successful high pressure cementing, frac, and testing operations. This squeeze packer experience has made important contributions to the design of these new dual production packers.

That's only a brief look at the story of these remarkable packers. A few more of the interesting facts are spelled out by the pictures and text below. For a complete fill-in on Baker snap-set duals and the hookups they're used in, consult Baker's field staffs and send for literature.

FACTS ON PLANNING DUAL-STRING COMPLETIONS

Baker field staffs have all the latest facts and figures on Baker's intensive continuing study of dual-string completions. They will welcome your inquiries. We will also be glad to send you the latest literature. Please write Baker Oil Tools, Inc., P.O. Box 2274, Terminal Annex, Los Angeles 54, California.

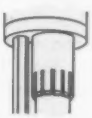
TWO BASIC MODELS. Model J (Product 756-J) is long-string set. Model K (Product 756-K) is short-string set. Both come with or without hold-down buttons (double or single grip). The pictures show single-grip Model J.

WHAT MAKES A GOOD DUAL PACKER?

The text above tells some of the things that are important. Here are a few more of the facts, starting with big unrestricted bores. Big bores are important because they permit you to run instruments and workover tools. These are probably the largest bores it's possible to design into a dual packer. For instance, a Baker dual packer for 7" casing is full-opening for two strings of 2⅜" tubing.

POSITIVE PACKOFF AND RELEASE

This three-element packing element design achieves a positive and lasting packoff with minimum set-down weight. It also simplifies release when you want to reposition or retrieve. What makes this possible is that the design prevents packing element extrusion without using the conventional metallic back-up rings that sometimes stick to the casing and defeat retrievability.

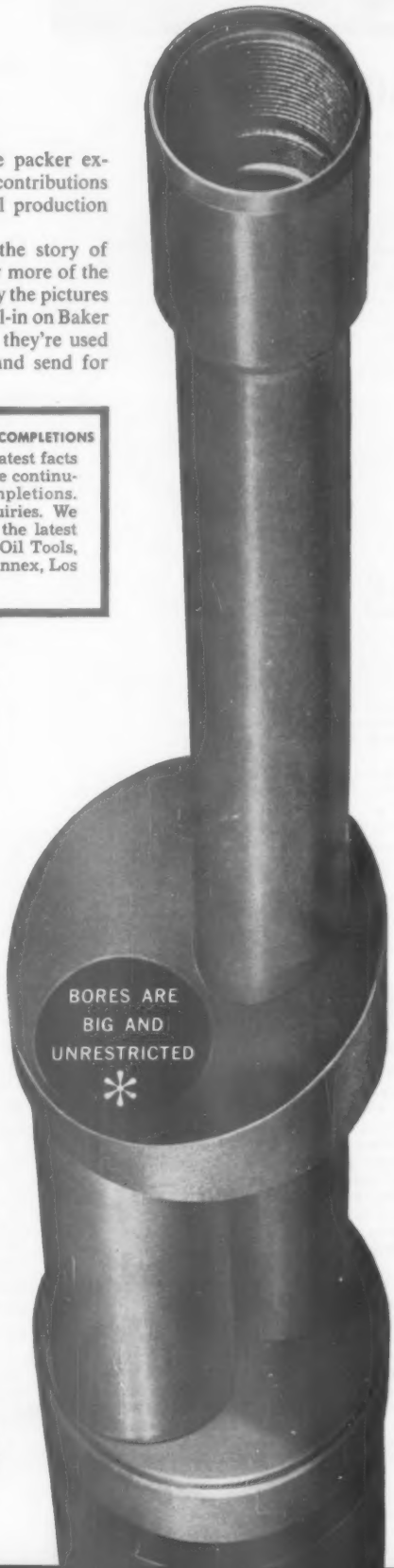


WHY SNAP-SETTING IS IMPORTANT

This simple snap-latch is what makes a Baker dual packer so easy to set and unset repeatedly. There are no one-shot shear pins. There's no ball dropping, no pressuring, no rotation. Just set down minimum weight to set packer, and pick up to release. This simplifies spacing out and enables you to test packers before displacement.

YOU CAN DISPLACE WHILE FLANGED UP

Using a side door completion valve, or sleeve valve, or other method, you can displace mud and wash in both zones with well head flanged up and under complete control.



BAKER

SNAP-SET DUAL PACKERS

BAKER OIL TOOLS, INC. HOUSTON • LOS ANGELES • NEW YORK

Why we keep harping on conservation practices

MIXED REACTIONS to the Journal's recent series of articles on conservation in Kansas (p. 79) illustrate the difficulties all states are having in modernizing their oil and gas regulatory practices.

As we have found in other states, we learned that Kansas' statutes and regulations are a poorly dovetailed patchwork, out of tune with today's technology and economic conditions, confusing in application, and considered inequitable by many producers.

But in Kansas, as elsewhere, there are producers and officials quite satisfied with the status quo. Some may profit from quirks and special provisions. Others, through habit or inertia, just don't want to be bothered with change.

FOR SEVERAL YEARS the Journal has urged all producing states to take a thorough and objective look at their regulatory systems, and to revise them where necessary to meet the fundamental objectives of conservation.

It is ironical that some of the newer producing states have much better systems than some of the older ones. States like Kansas, Oklahoma, and Texas, that took the lead in conservation a quarter-century ago, are now behind the times in many respects.

Knowledge of reservoir behavior and the techniques of oil recovery have advanced tremendously in recent years. Concepts of subordinating private rights to the public interest are on firmer legal ground than when the early conservation laws were tested in the courts. And certainly economic conditions in the oil industry have changed.

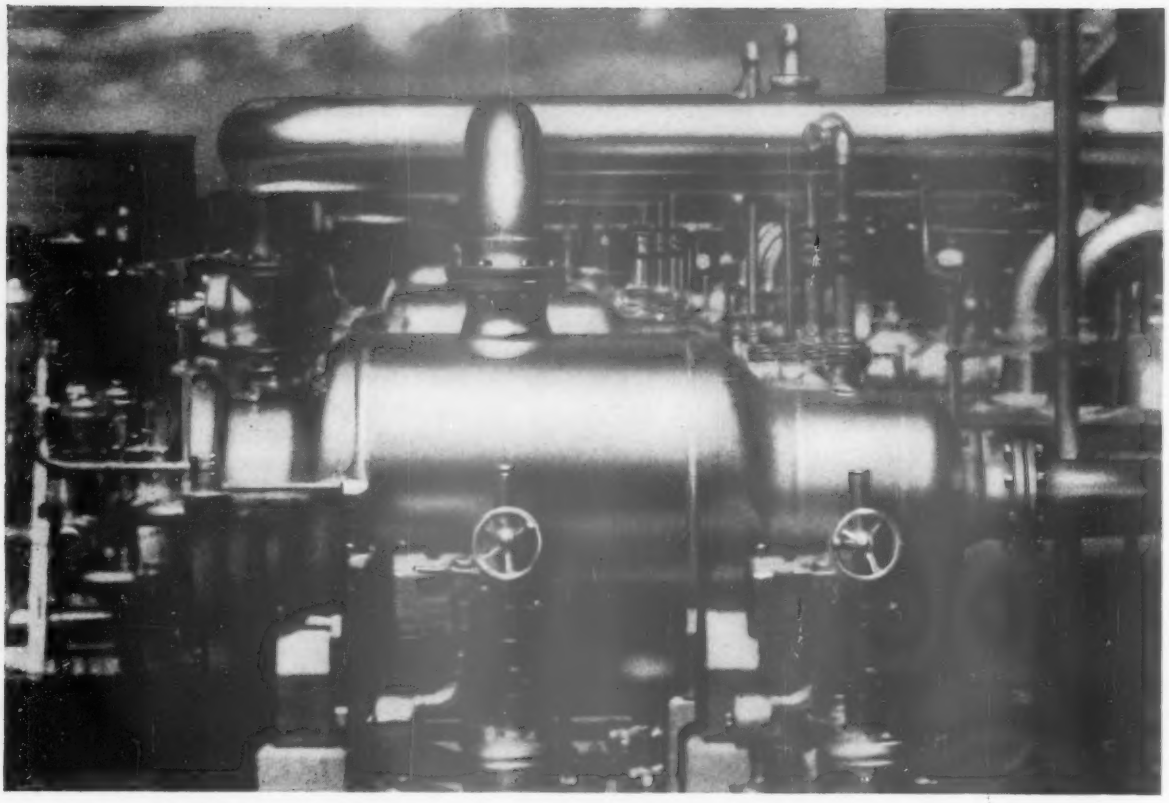
The Journal's position is that sound and equitable conservation is necessary for the survival of the oil industry and for the public interest; that this can best be achieved at the state level; but that if the states fail, the federal Government may be tempted to move in.

That's why we keep needling various states—and the Interstate Oil Compact Commission—to live fully up to their responsibilities and opportunities. Our purpose is not to stir up trouble but to forestall the greater trouble of federal intervention.

THE FAULTS WE FOUND in the Kansas system are samples of practices that should be reexamined everywhere. Perhaps certain of these practices need not be disturbed. But certainly a critical look at all of them is much in order.

It seems pathetic and futile for state officials to gather at Interstate Compact meetings and virtuously draft model laws for other states to adopt while making little effort to apply the approved practices in their home states.

If oil is to remain a progressive industry, its regulations and its regulators must be progressive.



How Monel alloy promotes automatic self-cleaning of strainer

It may be years before Maintenance cracks its first nut on these automatic Thornhill-Craver jet strainers.

No need! Everything about these strainers provides remote-operation reliability. The units even bypass and then clean themselves, triggered by build-up of pressure differential between dirty and clean sides of their screens.

Screen construction is equally ingenious

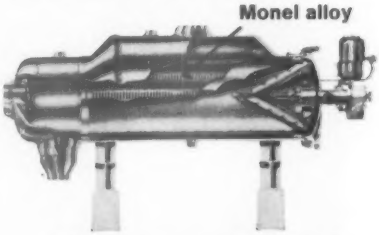
Not the least ingenious feature of these strainers is the screen design. The mesh is woven Monel* nickel-copper alloy wire. Monel alloy is a natural choice for its resistance to stream corrosives. The pH runs 4 to 5. Chlorides, sulfides, and carbonates along with trace water and dissolved oxygen are present.

But there is a little more to it than that. With Monel alloy, it's practical to use mesh as small as 400 mesh and really clean the petroleum products stream. Two reasons. One, Monel wire doesn't "grow" (from build-up of corrosion products) and so block the aperture. Two, sludge is easily flushed off Monel.

Excellent through-put

Along with small holes for maximum straining, Monel alloy permits small wire for maximum flow. It provides both the corrosion and abrasion resistance and the strength needed to insure long life in thin wire. For making reliability doubly sure, Thornhill-Craver backs up the mesh with a slotted membrane stamped out of Monel sheet. For additional information about these strainers contact Thornhill-Craver Company, Inc., of Houston, Texas.

Monel alloy



Where do you need improved metal performance?

Metals that fail prematurely or need constant care... frequent redressing, for example... can often be replaced with Monel or one of the other Huntington alloys at a considerable overall saving. It's a point to remember next time you specify material. For help in selecting the specific alloys, simply contact:

*Inco trademark

HUNTINGTON ALLOY PRODUCTS DIVISION
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67 Wall Street New York 5, N.Y.

MONEL®

A First-Quarter Look at Oil

Rank by Net Income	GROSS INCOME 1960	GROSS INCOME % Change	NET INCOME 1960	NET INCOME % Change	REFINERY RUNS (Barrels daily) 1960	REFINERY RUNS % Change	LIQUID PRODUCTION* (Barrels daily) 1960	LIQUID PRODUCTION* % Change
Jersey Standard	2,212,000,000	+ 2.60	170,000,000	+ 1.80	2,893,000	+ 0.63	2,556,000	− 1.27
Texaco	733,868,103	+ 1.73	97,300,000	+ 3.73	1,290,297	+ 5.26	1,196,230	+ 9.24
Gulf	.....	.....	81,824,000	+22.72	779,000	+ 17.67	1,433,000	+11.43
Standard (Calif.)	479,598,078	+ 7.23	60,727,978	+ 5.44	489,109	− 1.39	414,000	+ 2.22
Socony Mobil	.....	.....	47,200,000	+ 4.42	.....	.....	.....	.....
Shell	457,553,566	+ 1.18	34,545,433	+ 0.23	492,000	+ 3.58	375,000	+ 0.81
Phillips	301,426,810	+ 0.53	26,803,588	− 0.11	242,841	+ 4.13	284,868	+11.36
Continental	200,326,000	+ 3.58	15,280,000	+ 2.51	193,840	+ 8.15	204,159	+12.76
Cities Service	.....	.....	12,974,000	− 5.03	275,500	− 8.33	143,100	+ 0.49
Sinclair	334,303,440	− 0.87	12,307,918	−28.38	421,623	− 3.96	178,610	− 6.51
Ohio Oil	92,053,891	+22.47	10,278,741	+ 0.79	†99,637	+119.95	108,670	− 3.01
Sunray Mid-Cont.	111,947,000	− 6.10	9,440,000	−15.30	148,870	− 1.36	92,468	+ 8.87
Sun Oil	182,806,000	− 9.99	8,789,504	−21.71	.....	.....	.....	.....
Atlantic Refining	153,601,000	− 1.10	8,726,000	−29.32	194,164	− 5.58	151,062	+11.61
Richfield	86,578,058	+ 3.55	6,994,609	+25.24	146,275	+ 6.59	96,560	+ 9.12
Skelly	65,339,513	− 5.05	5,908,689	−10.44	50,341	− 5.48	64,276	− 3.97
Union Oil	123,209,000	+ 3.85	5,530,000	+13.09	152,077	− 6.01	95,813	+ 4.14
Standard (Ohio)	93,100,000	+ 0.32	5,066,000	− 0.59	144,000	.....	30,600	+ 0.99
Champlin	‡20,360,681	− 1.48	1,859,614	−16.39	27,605	+ 5.81	24,434	+ 5.85
Anderson-Prichard	17,627,264	− 1.23	1,351,907	+ 0.34	30,468	+ 1.00	14,829	− 0.87

*Includes crude and natural-gas liquid production. †Includes refining capacity acquired in Aurora Gasoline merger. ‡Net sales.

Oil Profits Harder to Come By

• First-quarter 1960 reports of companies dramatically show impact upon industry earnings of depressed product prices. They offset high volume sales of products, petrochemicals, and natural gas.

OIL companies, like American business in general, failed to make their expected jet-away into the Booming Sixties during the first quarter.

In fact, there were a few engine misfires under the hood.

The international companies generally marked up fair gains in first-quarter profits—but only a few of these were on the spectacular side. The domestic-centered companies found it tougher to show an increase in profits. Some dropped behind their 1959 first-quarter earnings.

Even where the companies managed to increase their operating volumes, benefits derived from greater production and refinery runs were offset by lower product prices.

First-quarter statistics explain the industry's plight. Although total petroleum demand lagged during the first 2 months of 1960, crude production and refinery runs topped last year's experience. The result was that stocks of gasoline and middle distillates remained higher than last year and caused the price uneasiness.

Cold weather in March cleaned up stocks of middle distillates and residual, but by then the chance for profits had vanished. Gasoline stocks, however, remained high right up to the present. They continue to depress prices just before traditional opening of the motoring season on Memorial Day. Much of the chance for second-quarter profits will depend on what happens to gasoline prices in the next few weeks.

The gainers . . . Jersey Standard kept its place as the top profits maker in the oil industry, but Gulf grabbed the spotlight with a startling 23% gain for the quarter.

Ralph O. Rhoades, Gulf board chairman, told stockholders the $81.8-million first-quarter profits were the second highest for a first quarter in company history. He also was optimistic about the outlook for the rest of the year.

"We consider it likely that operations will be at high levels so far as volumes are concerned. Our latest forecast still indicates an increase in the domestic demand in 1960 of about 3.5% over that of 1959.

"With the attempts now being made by the domestic industry to achieve a

better balance between supply and demand, we may hope for more stability in price structures."

Gulf enthusiasm was fueled by important discoveries in Venezuela, by three good producers on Gulf's Libyan holdings, and by approval of gas exports by Canada which will benefit a subsidiary, British American Oil Co.

The Venezuelan and Libyan discoveries are expected to turn into major developments for Gulf subsidiaries. The Canadian action also means that British American, the largest single holder of proven gas reserves in western Canada, will furnish about 26% of the total gas required by two of the largest gas exporters.

Domestic production of crude and condensate by Gulf showed about 11% gain in the first quarter, and a substantial increase is also predicted in sales of gas and gas liquids during the rest of the year. The reason: Gulf holds a 32% interest in the new Transwestern Pipeline Co. which will move large quantities of Gulf's natural gas from New Mexico and Texas for sale in California.

Jersey Standard's $170-million first-quarter profits were 2% above the same period last year and 11% above the 1959 final quarter.

President M. J. Rathbone reported substantial sales of products, petrochemicals, and natural gas plus operating efficiencies more than offset continued pressure on prices in Jersey's markets.

Product-sales volumes for the first quarter increased about 5% compared with the same 1959 period and were more than 3% above last year's fourth quarter. Total revenues were calculated at $2.2 billion for the quarter compared with $2.1 last year.

Capital and exploration expenditures by the Jersey family of companies were estimated at $186 million. They totaled about $200 million for the first quarter in 1959. Of the 1960 outlay, $142 million went for property, plant, and equipment. The remaining $44 million was made in the search for oil and gas.

California Standard showed a 5% gain in earnings when profits moved from $57.6 million to $60.7 million in the first quarter.

Chairman R. G. Follis attributed the gain primarily to increases in domestic production of natural gas and crude oil and from higher petrochemicals sales.

Gas sales, for example, jumped to 708,000 M.c.f. daily, compared with 546,000 M.c.f. daily for the same period in 1959.

The company's gross production of crude oil and natural-gas liquids in the Western Hemisphere totaled 414,100 bbl. daily. This was less than half of California Standard's world-wide production of 945,000 bbl. daily, which is a sharp gain over production of 874,700 bbl. daily for the first quarter of 1959.

Follis reported that one highlight of the company's first-quarter activities was an important oil discovery on the Standard-Richfield Unit of Alaska's Kenai Peninsula. Completed tests on the discovery well indicate it has an excellent potential, considerably strengthening expectations for major oil development in the area, he said.

Another strong first-quarter showing was turned in by Continental Oil Co., which boasted all-time high earnings for the period. Consolidated net income was $15.3 million compared with $14.9 million in the first quarter of 1959.

Chief factors contributing to the higher earnings were a 4.7% gain in crude-oil production and a gain on the installment sale of leasehold rights. Continental noted that offsetting factors were lower prices both for crude and refined products.

Optimism . . . Other first-quarter reports struck notes of optimism for Canadian operations, the natural-gas industry, and the long-term outlook for refinery expansion.

Imperial Oil Ltd. President J. R. White told his stockholders that growth prospects were good in Canada both on the short and long term. White saw a 9% increase this year in oil production in western Canada. This is substantially higher than other industries can expect.

White said during the next 10 years world-wide demand for petroleum is expected to increase at a rate requiring the discovery of new reserves of 10 billion barrels each year.

As for prospects of refinery expansion, Texaco President James W. Foley made this observation: Sufficient capital must be provided nearly to double present world refining capacity of 16,200,000 bbl. daily. This will be needed to process the 30 million barrels a day which it is estimated will be consumed every 24 hours in 1969.

Majority of the oil companies recorded increased gas sales. Two of the major gas-transmission companies reported record volumes of gas deliveries during the first quarter.

Texas Eastern Transmission Corp. had net income of $8,591,754 compared to $6,106,757 for the same 1959 period. Transcontinental Gas Pipe Line Corp. reported a net income of $5,376,475 compared with $5,180,930 last year.

Price squeeze . . . The several companies failing to enjoy a gain in first-quarter profits had a common explanation: Tighter production allowables, softer product prices, higher expenses.

Skelly President Don Miller noted in his report that the drop in net income came because production allowables held about 14% below a year ago and products prices softened.

He said numerous localized price wars reduced gasoline realization, and heavy industry inventories of distillates resulted in sharp breaks in distillate prices. The cold weather in March permitted a substantial reduction in distillate stocks but the withdrawals came too late to do more than to halt further price declines.

Ohio Oil Co. President J. C. Donnell II, in explaining why his company was able to show only a slight gain in profits, observed: "A significantly lower level of refined products prices, a small reduction in crude-oil production, and higher exploration expenses were the primary factors limiting the company's earnings."

Tidewater President George F. Getty II attributed his company's drop in earnings to depressed East Coast fuel-oil prices in January and February and low gasoline prices on both coasts.

The serious impact of low product prices was dramatically reflected in Sinclair Oil Corp.'s report. Earnings dropped 28% compared with the 1959 first quarter yet Sinclair enjoyed the highest first-quarter volume of refined product sales in the company's history.

Lower prices also offset higher income from sales of petrochemicals and natural gas and nullified the gains from a program of economies and increased efficiencies, the report stated.

A closer insight into price trouble was given by Atlantic Refining Co. and Sun Oil Co.

Atlantic reported its gasoline prices in the first quarter were 4% below a year ago and furnace-oil prices were down 11%. Sun reported the average price it received for gasoline was 19 cents a barrel less than last year. The average for distillates was 48 cents a barrel lower. These price reductions cost Sun $5,350,000 in lost revenue.

Cities Service Chairman Burl S. Watson noted that demand for products continued to increase at a modest but satisfactory rate in the quarter. But he observed that the depressed prices could ruin profits for the year. The outlook for the year as a whole, he said, will be determined by the industry's ability and willingness to bring supply in line with demand.

Appointments May Further Delay FPC Action

• It will take time for the two lawyers named by Ike to get acquainted with FPC procedure. Neither has any regulatory commission background and they may face a fight when up for senate confirmation.

PRESIDENT Eisenhower last week settled the question of who would be appointed to the Federal Power Commission by naming two government lawyers to the posts.

Thomas J. Donegan, a former FBI agent and now a member of the Subversive Activities Control Board, was named to replace William R. Connole when the latter's term expires June 22.

Paul A. Sweeney, first assistant in the Justice Department's office of legal counsel, will fill out the unexpired term of the late John B. Hussey.

Each man has been a government career attorney for many years. Neither has had any regulatory commission background, although Sweeney has worked on some gas cases handled by the justice department for the FPC.

In making his appointments, Eisenhower made it clear that he deliberately chose men who had no connection with any segment of the gas industry in any way.

He conceded that this was a break with his past practice of appointing men familiar with some phase of the industry or its regulatory work. For instance, Connole has previously served on a utilities regulatory commission in New England and was generally regarded as a "watchdog" for consumer interests. And Hussey, from Louisiana, had served on the state regulatory commission there and was familiar with oil and gas production problems.

James C. Hagerty, the president's press secretary, said the President had reached the conclusion that "members should be representative of all sections of the United States, and not one segment of the economy."

The President's surprise choices immediately raise two topics of speculation in Washington:

. . . **Will the Senate** confirm the appointments?

. . . **Will the appointments** cause new delay in FPC handling of its growing backlog of cases?

Normally, presidential appointments to a regulatory agency are confirmed by the Senate in routine action. However, there are at least two reasons why this may not be true this time.

First, eastern congressmen may try to make a political issue over the dropping of Connole and the failure to appoint as his replacement an advocate of protection for consumer interests.

Furthermore, some senators—particularly Democrats—may seek to stall confirmation action until adjournment, thereby leaving permanent appointments to be made when a new president takes office.

Such a move, coupled with the fact that the term of Commissioner Arthur Kline expires next June, would give the new president an opportunity to appoint three members—a majority—to the commission in his first 6 months in office.

Concerning the effect of last week's appointments on the log jam of FPC cases, current speculation runs like this:

Since neither of the two is familiar with the issues in the major cases at the FPC, it would be logical to suppose that considerable time would be necessary to put them in a position to formulate their opinions.

There is a possibility that the present commission may act on some of the major cases—particularly the long-standing Phillips case—before Connole's term ends in June. However, Hussey's death and the current congressional probe of the commission have already caused some delay and more may develop before the probe is finished. Too, the three remaining commissioners may want to avoid a decision which would be participated in by a "lame duck" commissioner—Connole.

All in all, the FPC investigation and the President's appointments may add as much as a year to the time the industry must wait for decisive action by the commission.

The New FPC Commissioners

PAUL A. SWEENEY should be thoroughly familiar with the inner workings of the federal Government because he has been a government attorney in Washington most of his professional life.

Sweeney, 64, received his college training at Georgetown University in Washington. After getting his law degree in 1921, he returned to Oklahoma, where he had attended high school, and began law practice in Tulsa.

He joined the Justice Department in 1924 and was assigned to the war transactions section. From 1928 until 1932 he was on the American - Mexican Claims Commission in the Department of State.

Sweeney rejoined the staff of the Justice Department in 1933 and has been with the department ever since. He served as chief of the appellate section for several years and in that role argued numerous cases in the U. S. Supreme Court, the U. S. Court of Appeals, and various state supreme courts. Some of the cases he handled involved the Federal Power Commission and natural-gas matters.

In 1958, Sweeney was promoted to first assistant to Assistant Attorney General Malcolm R. Wilkey, head of the department's office of legal counsel.

Sweeney is a Democrat.

THOMAS J. DONEGAN gives this summary of knowledge of the natural-gas industry:

"I've never had anything to do with utilities outside of paying my gas bill," he said last week.

Donegan is a lawyer from New York. He served with the FBI for 13 years (questioned German saboteurs put ashore from a submarine on Long Island during World War II) and as a Justice Department lawyer he assisted in the Government's prosecution of Alger Hiss.

His career in the Justice Department, intermingled with stretches of private practice in New York, has included serving in the department's security division, chairman of the personnel security advisory commission in the White House, and as a member of the Subversive Activities Control Board. He has been at the latter post for the past 3 years.

Donegan, 63, was born in Brooklyn. He is a graduate of the Fordham law school.

Venezuela to Be in Oil Business Soon

• TIPRO hears how government company will operate. Dr. Perez Alfonzo says some things will be played by ear, but drilling will start in 6 months.

VENEZUELAN Petroleum Corp., the new Venezuelan government oil company, is expected to complete filling out its executive staff within 2 weeks. And it likely will spud in its first wells within the next 6 months.

This is the tentative timetable given the Journal last week by Dr. Juan Pablo Perez Alfonzo, Venezuelan Minister of Mines and Hydrocarbons.

Beyond this point, the minister indicated, the company will play it by ear in its ultimate aim to become a completely integrated oil operation.

"We plan to go all the way. The company was organized on that basis. Any move by VPC toward developing its own refining and marketing facilities, however, is yet sometime off. And specific plans in this direction have not been made."

Initially, Dr. Perez Alfonzo told the Journal, VPC does not intend to do any exploring for oil. It will confine its drilling operations "to the most safe places" namely those areas awarded to it that have been essentially proved by private-company drilling on adjoining concession acreage. The company will start off with slightly less than $1,000,000 (2,500,000 Bolivars).

On the important question, especially to other operators in Venezuela, of how VPC will market the oil that develops from such drilling, Dr. Perez Alfonso shies away from any direct answer.

He says merely that "we shall wait and see what happens." Several large U. S. oil firms in the country will be nervously doing the same thing.

Venezuelan crude generally is meeting increasingly intense competition for world markets. If private operators were called upon to market VPC crude, this crude would almost certainly have to displace other Venezuelan crude from a market.

Reassurances offered . . . Financing for the new government company, the minister said, "will not be a bottleneck." Venezuela's oil workers, he said, have long been in favor of a government company and stand ready to subscribe funds for its operation.

VPC will begin "as a small operator in a few proven areas." It will also own and operate the national gas lines that will be transferred from the Venezuelan Petrochemical Institute.

The minister attempted in an address last week before the Texas Independent Producers and Royalty Owners Association convention in Tyler, to allay some of the industry fears stirred up by the formation of the government company.

VPC, he said, "will pay taxes and will be ruled by the same laws and regulations as the private oil companies.

"I would like to add that the VPC will not interfere in any way with the normal activities of the oil industry."

VPC, the minister said, will operate like all other commercial companies, "though keeping in mind always the national pricing and production policies."

Why it was formed . . . The Venezuelan minister gives two prime reasons for the formation of the government company.

First, the company is seen by the government as a means of easing the eventual transition in Venezuela from an economy based almost wholly on oil to one without oil.

Crude-price reductions in 1959 cut deeply into government revenue, upsetting the budget, and further intensifying the government's urge to diversify the national economy.

Earnings from VPC, the minister pointed out, will stay in the country. He hints that at least a portion of these earnings will be spent to broaden the base of the Venezuelan economy—in other words, to create new industry.

Furthermore, Dr. Perez Alfonzo said, the government cannot justify the participation of private capital in exploiting the relatively proved areas where little risk is involved.

"Notwithstanding the large promising areas held undeveloped by the private companies, the government deemed it convenient to promote directly the increase of petroleum reserves."

Choice Maracaibo Acreage Goes to National Company

VENEZUELA'S new national oil company will begin operation with almost 350,000 acres of the country's choice semi-proved acreage firmly in its grasp.

Biggest stumbling blocks seen so far in getting the company under way are a lack of qualified personnel and the fact that this choice acreage is about all it has in the way of assets.

The bulk of the national company's acreage is 134,739 hectares (slightly more than 330,000 acres) in Lake Maracaibo. The acreage surrounds and offsets production on the west, south, and east (OGJ, Apr. 25, p. 124).

In addition to this territory, the new company has alloted 6,343 hectares (about 15,600 acres) in the State of Anzoatequi. Most of this land is in Oficina and a small portion in Anaco.

A third small tract handed the new company is 307 hectares (about 758 acres) in the Las Mercedes region of Guarico.

Dr. Juan Pablo Perez Alfonzo, minister of mines and hydrocarbons, placed a total value of 600,000,000 bolivars or about $180 million on the 141,389 hectares (349,230 acres).

Primary problem facing the company is a complete lack of working capital until after a new budget is drawn up July 1, and then a working capital for the first year of only 2,500,000 bolivars ($570,000). Assuming the first drilling will be in the Maracaibo acreage offsetting established production, this amount of money won't buy much drilling.

The July 1 date also carries another stumbling block. The best Caracas rumors last week hint at a pay cut for all government employes beginning July 1. It will range from 1% to 20%.

This is hampering the government's efforts to recruit qualified personnel to run its new company. Qualified Venezuelans employed by oil companies at good salaries and looking toward promotions are loathe to turn their back on a good thing to work for the government company.

TWO TOP FOREIGN oil leaders, Venezuela's Dr. Juan Perez Alfonzo, left, and Saudi Arabia's Sheikh Abdulla Tariki, chat during the TIPRO meeting.

World-Wide Proration Urged

. . . by Arab leader at TIPRO meeting. Tariki says stabilized international oil business will help big exporting countries whose budgets are tied to oil income.

SHEIKH Abdulla Tariki of Saudi Arabia last week spelled out the broad outline of his plan to stabilize world oil prices via international market-demand proration.

Tariki, Saudi Arabia's director general of petroleum and mineral affairs, proposed that net crude-exporting nations join to set up a commission that would prevent production of oil in excess of market demand.

Speaking before the annual convention of the TIPRO, Tariki declared that such an international system is greatly needed and is just as logical as is proration on the state or national level.

It has all the justifications, Tariki said, of the current international coffee convention or of the various European economic blocs.

How it would work . . . The sheikh's concept would restrict membership on the commission and the actual effects of such proration to those few countries who are net exporters of oil—who export more than they import. This, of course, would not include the United States.

Tariki recommends that an international commission be formed consisting of two divisions:

. . . **A policy-making** group composed of representatives of each of the participating countries.

. . . **An administrative group** of permanent staff made up of the necessary technical, administrative, and clerical personnel.

The proration formula . . . The basic factor to be considered in setting up any international proration formula, Tariki says, should be the proven reserves of each country. "Uniform methods of reserve estimation would be used," he adds.

Room should be made in the system for future discoveries—"either within a country already participating or in new oil producing countries." New net exporting nations would be invited to participate.

There would also be a need for a correction factor which would take into account the participants' current market position.

This, Tariki said, would prevent a country from experiencing any undue loss of revenues during the early stages of proration. Future increases in demand, however, "would be allocated in such a way as to eliminate or minimize this consideration."

Need seen as great . . . The need for an international proration system which would stabilize world crude prices and production is vital to net oil exporters such as Venezuela and the Arab countries, Tariki said.

The sheikh pointed out that the economies of these countries are critically dependent on this one major resource and industry.

In the years 1958-59, he said, oil made up 27% of the total government income in Iran, 47% in Iraq, 60% in Venezuela, and 81% in Saudi Arabia.

Thus, "it is obvious that price fluctuations in the market can easily upset the delicate balance between their incomes and budgeted expenditures, resulting in serious disruptions in the general economy."

This is well illustrated, he said, by the losses in government income sustained by the Middle East countries as a result of the cut in posted crude prices in February 1959.

These losses, roughly, the sheikh said, were: $27,000,000 in Iran; $24,000,000 in Iraq; $46,000,000 in Kuwait, and $35,000,000 in Saudi Arabia.

These countries recognize, Tariki said, that conditions exist—with world productive capacity far exceeding demand—"for the development of destructive competition in the form of dumping or price wars which could result in disaster for the exporting countries.

"This would be intolerable today."

No monopoly seen . . . Tariki stresses that there "are no concealed motives behind the concept of international proration."

The objectives, he contends, would be to stabilize markets, prevent economic waste, and conserve an irreplacable natural resource. They would not be to control supply so as to set confiscatory prices.

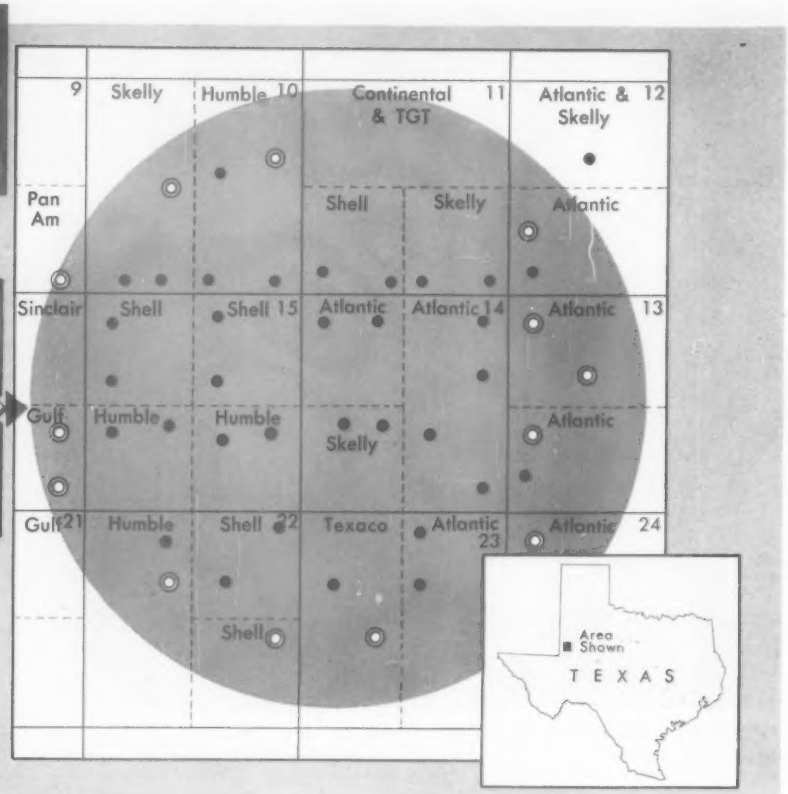
The sheikh acknowledges that the most controversial part of his plan is that of "stabilizing markets."

But there would be no monopoly, he argues, "because the domestic petroleum industries of the many importing nations will continue to be a potent force in the determination of prices."

Atlantic's Proposed Miscible Drive in West Texas Field

How it will work:

Injection of propane, then gas, and then gas and water around this periphery will increase recovery from Block 9 field to 89% of the original oil in place.



Unique Miscible Program in the Mill

- Atlantic is awaiting go-ahead from Railroad Commission on miscible drive aimed at big boost in recovery from field in Andrews County, Texas.

PERHAPS the most unusual miscible drive yet is that planned by Atlantic Refining Co. and other operators in the Wolfcamp reservoir of University Block 9 field in West Texas.

The pressure-maintenance program planned in the 13,000-acre Andrews County field will employ the Atlantic-developed high-pressure, gas-injection process.

But the operators will have to pump up the Wolfcamp for about 2 years with 10 billion cubic feet of gas and 2,000,000 bbl. of water before reservoir pressure climbs high enough to maintain this type of miscible drive at top efficiency.

Using a peripheral pattern—again unusual for a miscible program—the operators plan to inject a slug of about 2,250,000 bbl. of propane at the outset of the program. The propane slug would serve as an "interim" miscible drive while reservoir pressure is still too low for the ultimate high-pressure gas drive.

They plan to follow the slug with a volume of injected gas equivalent to about 10% of the Wolfcamp's hydrocarbon pore volume. Then, in the last phase, gas and water would be injected simultaneously—the water to improve the areal sweep of the miscible drive.

Huge recovery boost . . . The program will repaint the picture of Block 9 Wolfcamp from that of a reservoir with a prospective meager primary recovery to one with a spectacular ultimate oil take.

The 8,400-ft. reservoir so far has produced only about 4,300,000 bbl. of oil of a total 51,000,000 bbl. estimated by Atlantic to be in place originally. Primary methods would recover only about 17% of that total, it thinks.

A water flood, Atlantic estimates, would jump the total oil take to about 40% of that in place.

The miscible program, however, would dwarf this. Atlantic estimates that it will hike the total pool recovery to about 44,500,000 bbl.—or between 87 and 89% of total oil originally in place.

Cost of the entire program, including the expense of purchased gas and propane, would run about $2,225,000.

July start planned . . . The operators' plans to unitize the project area and carry out the miscible drive are now before the Texas Railroad Commission for approval.

They hope to launch the program in the 45-well field and start injection by July 1.

Average bottom-hole pressure in the Wolfcamp now is down to less than 1,485 psi. from the original 3,500 psi.

During the next 2 years, operators plan to boost the average pressure to 4,300 psi. and hold it there. At this level, it would be about 800 psi. over the initial pool pressure.

Fluids injection through the 13 peripheral input wells during the 2-year period alone would be about

10,300,000 bbl. of which 8,300,000 bbl. would be hydrocarbons.

The 10 billion cubic feet of gas that would be injected would be equivalent to about 6,100,000 reservoir barrels in volume. To that would be added 2,250,000 bbl. of propane and 2,000,000 bbl. of water.

Majors join . . . The program is a bit unusual also in that it is one of the first large-scale miscible projects in which several major companies have joined.

Participants, along with Atlantic, include: Texaco Inc., Gulf Oil Corp., Shell Oil Co., Humble Oil & Refining Co., Skelly Oil Co., Pan American Petroleum Corp., Tennessee Gas Transmission Co., and Sinclair Oil & Gas Co. Atlantic says Continental Oil Co. plans to sign the unit agreement soon.

So far 99.4% of the total working interest has signed the agreement, with Conoco the only outstanding interest. The University of Texas is the sole royalty owner in the unit area, and it also has signed the agreement.

The unit participation formula is based 100% on acre-feet of pay.

Proposed rules include provisions for a net gas-oil ratio, for gas and water banks on a net reservoir voidage basis, for a unit allowable equivalent to the sum of the allowables of the 45 wells in the unit, and for authority to convert additional wells to injection service without special hearing.

Humble Absorbs Enjay

STANDARD Oil Co. (N. J.) is consolidating its domestic chemical marketing operations into a single division under the new Humble Oil & Refining Co.

Enjay Co., Inc., a Jersey subsidiary, will become Enjay Chemical Co., a division of Humble, on May 31. Headquarters will remain in New York.

Heretofore Jersey's chemical marketing has been handled by Enjay and by the Esso Standard and Humble divisions of the Humble company. Under the new setup Enjay Chemical will be directly responsible for the marketing and coordination of all the Humble company's petrochemical products in the U. S.

In addition to its domestic operations, Enjay Chemical will sell chemicals to Jersey's Esso Export Corp. for foreign marketing.

President J. E. Wood, III, of Enjay Co. will be president of the new Enjay Chemical. Other officers include R. K. Dix, A. D. Green, and K. J. Nelson, all vice presidents.

watching WASHINGTON

Clyde La Motte

• Oil presents sound evidence in TBA hearing . . .

REP. JAMES Roosevelt (D.-Calif.) appeared somewhat nettled, if not downright dismayed, at the trend the hearing before his subcommittee was taking.

The reason was simple: Large holes were appearing in the "case" that had been built up to show that some, if not all, major oil companies had been guilty of coercing independent service-station dealers into handling specified brands of tires, batteries, and accessories.

The reason the case was beginning to resemble cheesecloth was that company spokesmen were presenting affidavit after affidavit from the very dealers who were supposed to have been coerced. And these affidavits by the dealers clearly stated that no such thing had happened.

Too, whereas the original testimony presented last December had largely been hearsay evidence by someone who had heard about the "mistreatment" certain dealers were getting, the testimony now being presented was first-hand, submitted in sworn statements.

• The case of the cancelled station lease . . .

IN MANY RESPECTS, the situation at the hearing resembled the developments in the Tulsa conspiracy trial. In each instance, charges had been made that sounded damaging. But when those charges were hauled out into the light of day, they dissolved.

For example, there was the case of a service-station operator whose lease had been cancelled. Clearly, this could be a situation in which a big, tough major oil company had tossed a helpless operator out on his ear because he hadn't jumped high enough when the company yelled "froggie."

As it turned out, however, that wasn't quite the way it happened. Instead, it went something like this:

The company became concerned when the station's gallonage began slipping sharply from its 27,000 gal. average. An investigation disclosed that the operator was concentrating on auto repair service.

Despite the company's protests, the gallonage continued to slip in the months that followed until it had dropped to 7,000.

At this point, the company put the dealer on a month-to-month lease basis, thus hoping to spur him into doing something about that loss of business. This didn't work either, so the lease was turned over to a new man while the old operator switched entirely to auto repair work at another location. Since all of this took more than a year, it was hardly strong evidence that the company had been rough on the dealer.

Furthermore, sworn testimony brought out the fact that this company, with hundreds of stations, had terminated only six leases in 3 years.

• Roosevelt still seeks to salvage something . . .

IT WOULD BE a mistake, however, to assume that the oil companies were able to make a convert out of Mr. Roosevelt.

While the congressman did appear to be convinced that many of the charges made against the firms had been proved false, he still made it evident that he will not drop the issue entirely.

He told a reporter later that the thing that still vexed him was the "attitude" of the companies.

"They belittle all critics of their way of operating, as if it would be impossible for them to improve their dealer relations at all," he said.

"Now if the companies would only express a willingness to sit down with us and discuss possible ways of avoiding these problems, I would feel that we were making some headway."

After all, the congressman apparently figures he should have something to show for his efforts on behalf of the little business man.

OPERATING COMMITTEE* for the independents in a planning session.

Six Independents Try a New Approach

• Taking a cue from foreign and offshore operations, they're pooling their resources to get into more expensive—and more promising—operations in this country. Now planned: A $3,000,000 program in South Louisiana.

Ted A. Armstrong
News Editor

SIX SMALL independents, squeezed between high costs and limited opportunities where they're now working, are teaming up to play in a bigger game, where the risks are greater but the stakes are even higher.

Like the bigger companies, who lay off some of their big risks with partners in foreign and offshore ventures, they're putting their money and their talents into a common effort.

Their objective is the deep and promising Miocene area of southern Louisiana.

They've already agreed on a tentative program calling for an investment of $3,000,000 and the drilling of 14 wildcats. They've already completed seismic work on three prospects and have reviewed the shooting on five more. Within 90 days, they expect to stake their first location.

To most of the group this unusual arrangement is unusual only because it hasn't been done before. Now that the group has been formed, it seems as logical a step as any ever taken by any of these old-line independents.

Says Alex P. Aven, a vice president of Eason Oil Co. and manager of group operations: "When you really get a concept of the Miocene area, you find that the only reason you're not there is the money. Then you try to figure a way to get in on it."

Why the change? . . . The six independents come up with eight good reasons for moving into the high-cost country. Four reasons are pluses for the Miocene area; four more are strikes against the areas they're now in.

They wanted to go somewhere because:

. . . **Exploration** in the older areas just isn't turning up reserves which are sufficiently profitable.

. . . **Gas prices** in the older areas are lower than in the new areas. The Federal Power Commission, in fixing Oklahoma prices, for example, has put that state at a disadvantage with Louisiana. Too, there are fewer pipelines in Oklahoma to take the gas, and the result is costly shut-in wells.

. . . **Cut-back allowables** are pinching. Payouts often are so long that what might be profit is going to the banks as interest.

. . . **The bloom is off** water flooding, and that's a major factor for many independents. Most good prospects are already being flooded, and those that are left are much more costly than they used to be.

This is why they want to go to southern Louisiana:

. . . **The Miocene** holds the promise of 800 bbl. of recovery per acre foot, compared with 200 in Oklahoma's Wilcox sand.

. . . **Better reservoir** performance and a better reserves picture.

. . . **A better** allowable schedule.

. . . **Multiple pays.**

Says David Bartlett, of Keener: "We're not cutting down on our present operations. We want to take some money and put it where we can get the most for it. That seems to be southern Louisiana."

Says John Duffy of Murphy: "We're all looking for a better place to work."

Bill Phillips of Great Lakes sums

*MEMBERS of the operating committee are, left to right, John C. Duffy, vice president of Murphy Oil Co. of Oklahoma, Inc., Tulsa; T. Winston Eason, president of Eason Oil Co., Oklahoma City, operator; Alex P. Aven, vice president of Eason and manager of group operations; W. V. Phillips, vice president, Great Lakes Carbon Corp.; and David A. Bartlett, partner, Keener Oil Co., Tulsa. Not shown are Bernard F. Desloge, Minerva Oil Co., St. Louis, and W. D. Orthwein, of W. C. McBride, Inc., St. Louis.

The Six Independents Involved in the Joint Deal

POOLING their bankrolls and talents to search for oil and gas in South Louisiana are these six small independents:

● **Murphy Oil Co.** of Oklahoma, Inc., Tulsa. This company was formed in 1951 to operate properties of its 43-year-old parent, Murphy of Pennsylvania, outside the Appalachian area. Murphy of Oklahoma has production in eight states and has leases or is exploring in many more. Its recent growth has been due largely to water flooding and direct purchase of reserves.

● **Keener Oil Co.,** Tulsa. As the successor to Keener Oil & Gas Co. of Ohio and the other companies formed or bought by D. A. Bartlett, this firm dates its history back to 1907. That was when Bartlett, a banker, came to Henryetta, I.T., and formed Deep Fork Oil Co. Keener Oil & Gas was formed in 1920 and a couple of years later absorbed all of the other Bartlett interests. The company operates a gasoline plant at Butler, Okla., and is owner of Dewey Supply Co.

● **Great Lakes Carbon Corp.,** New York. The company was formed in 1919 in Chicago as Great Lakes Coal & Coke Co. It formed its oil and gas division in 1941 to enter petroleum exploration and production. Division headquarters are in Tulsa. It operates in most of the areas east of the Rockies and is currently most active in Oklahoma and West Texas.

● **W. C. McBride,** Inc., St. Louis. This company was formed in 1917 following the death of W. C. McBride, its founder, who first established production in Pennsylvania in the 1880's. The company operates in 14 states and Canada and has district offices in Tulsa, Evansville, Denver, and Calgary.

● **Minerva Oil Co.,** St. Louis. This is one of the biggest producers of fluorspar in the U. S. It is also active in zinc mining and milling. Its oil operations were started in 1938 in the Illinois basin. Principal oil activity is water flooding.

● **Eason Oil Co.,** Oklahoma City. This independent company was formed in 1913 as Healdton Oil & Gas Co. It was merged with Eason Oil Co., a strictly marketing firm, in 1929. It was reorganized and took its present name and form in 1952. Until 1938, when its refinery blew up, Eason was a fully integrated company. It still has producing and marketing properties and operates natural gasoline plants. Its drilling division claims title as the oldest contract-drilling firm in continuous service in Oklahoma.

it up like this: "Here in Oklahoma it costs us $25,000 to look at the Wilcox. In Miocene country, the dry-hole cost is $250,000. If we hit in Oklahoma our well may produce 100,000 bbl.; in Louisiana it may produce 5,000,000 bbl. We're looking at prospects that will cost 10 times as much but can produce 50 times as much oil."

How it started . . . T. Winston Eason, president of Eason Oil, says the program dates back to 1954. It was then he began looking to other areas for better opportunities.

His studies crystallized his attention on southern Louisiana in 1957, and in early 1958 he turned his efforts toward organizing a group to get in on the deep Miocene play.

He isn't sure how the group idea started. But he remembers noticing that six contractors pooled their resources to build Boulder Dam. And more recently oil companies have teamed up to pool their money and talent for the high costs and big risks abroad and in the Gulf of Mexico.

The program fits the plans of the little companies well. Some had talked individually about teaming up, hiring a staff, and taking the risks of the deep play.

These plans dissolved in the difficulties and expense of finding the right people and setting up a base of operations.

The group approach now settled on has one interesting advantage, Phillips points out: It takes only cash and very little time of the executives of the individual companies.

The arrangement . . . Operations for the group are handled by Eason Oil Co. as operator. But all important decisions are made by an operating committee made up of a representative of each company.

Eason is paid a sum to cover overhead, travel, and other expenses. Each company then will kick in an equal share of the expense for any seismic, land, or drilling project.

Since each is jealous of his own independence, there's a provision that any company can decline to participate in any one project. However, it forfeits any money already spent on seismic work, lease acquisition, or other effort. If more than half drop out of any one project, the project must be abandoned by the others.

There will be no venture capital, no stock sales in the group project. Only company funds will be spent.

Why 14 wells? . . . The six independents are not interested in a short-term gamble for big production.

They set out to determine what it would take to outline a comprehensive program which would come as close as possible to guaranteeing success.

They made a serious study of success ratios of companies known to be good operators. They then delved deeply into the laws of probability. They have concluded that 14 wildcats will give them a 97¾% chance of success. Certainly they hope to do better. They're convinced that, despite the high costs, you can break even on fewer wells in Miocene country than you can in Oklahoma.

Detail preliminary work in south Louisiana is being done for the group by the consulting firm of Rogers, Seglund & Shaw. "They're on the spot and they know the country," says Eason. "They give us a better and cheaper approach to getting started than we could get by trying to undertake the work ourselves."

Figuring farmouts, dry-hole money, all drilling and exploration costs, they've concluded that they can drill these 14 wildcats for $3,000,000—and that's the program they're getting ready to kick off.

There's been one salutary effect of the group operation already. The six independents have become so well acquainted and so impressed with each other, several have gone into partnership deals elsewhere.

They're not convinced they'll make a lot of money in the Miocene venture But at this point they feel sure of one thing: It's the best opportunity for progress for small independents who are having trouble getting ahead where they are.

Wider Spacing Plan on Louisiana Docket

• Mouton sets hearing on independents and majors' proposal to increase state's 40-acre well spacing to 80 acres and to double allowable. The plan is aimed at eliminating excessive and wasteful drilling.

THE STATE of Louisiana will give the oil industry a chance May 24 to prove its case for wider well spacing and higher allowables for fewer wells.

Ashton Mouton, conservation commissioner, has called the hearing at Baton Rouge in response to a specific proposal made by independents and majors. They want to raise the state's 40-acre spacing regulation to 80 acres for new fields and to double the allowable.

Under the same proposal, wells drilled on less than 40 acres in new fields would have their allowable reduced proportionately.

The hearing will be of major importance to Louisiana producers, many of whom believe there is excessive and wasteful drilling under the present allowable formula, which is based solely on well depth (OGJ, Jan. 18, p. 41, and Jan. 25, p. 124).

So far no organized opposition to the plan has been voiced, although some is expected by the time the hearing is held.

If the new formula is approved by Mouton, who has the responsibility for making the decision, Louisiana hopes it will trigger more wildcatting. By relieving companies of excessive development spending they should be able to increase exploration.

Plan outlined . . . Specifically here are the five proposals on the docket of the hearing:

1. Modify the depth-bracket formula for establishing allowables by using an additional factor based on the amount of productive acreage assigned to each oil well. This would apply only to newly discovered pools.

2. Adopt rules establishing procedure under which allowable based on the modified formula can be placed in effect for each newly discovered pool.

3. Provide for exemption of newly discovered pools affected by piercement-type structures and other completely faulted areas and establish administrative procedure for the exemption of such pools.

4. Consider whether certain pools heretofore discovered but still in an early stage of development should be classified as newly discovered pools.

5. Consider an amendment of statewide order No. 29E to increase the well-spacing requirements in newly discovered pools.

Mouton said the industry wants to submit proof of the necessity for going to 80-acre spacing instead of 40 and, if this is done, be granted a double allowable for 80-acre wells in new pools.

Similarly, he said, those making the proposal want to cut allowables for drilling on less than 40 acres. If, for example, a well is drilled on 20-acre spacing it would get one-half the usual allowable.

Mouton pointed out that Louisiana's 40-acre rule is really a misnomer and that considerable drilling is done on less than 40 acres. The minimum requirement is for 900 ft. between wells, not 40 acres. In offshore wells, in particular, spacing is accomplished under this ruling to get producers on something like 17 to 25 acres.

In the overall, however, Louisiana's development has been around the 40-acre mark.

While Louisiana will undergo a change of state administration this week, Mouton presumably will remain in his commissioner post for the May 24 hearing and through most of this year. His term does not expire until December and incoming Gov. Jimmie Davis has not indicated whether he will reappoint Mouton or select someone else.

The change of governors—from Earl Long to Davis—will, however, affect immediately the state mineral board, headed by William G. Helis, New Orleans oil operator. Davis has not indicated whether he will reappoint Helis as chairman. Helis supported Davis in the campaign.

At the last meeting of the mineral board, which handles leasing of state lands, Helis reported that $307 million has been placed in escrow in the federal treasury pending a decision by the U. S. Supreme Court on the ownership of the Louisiana tidelands. The money came from rents, royalties, and bonuses of offshore acreage claimed by the state and federal governments.

In the 4 years Helis has served as chairman, he reported, Louisiana has collected nearly $314 million from offshore operation within the 3-mile Louisiana waters (Zone 1). This money consists of $176 million from royalties, $129.1 million from lease bonuses, and $8.7 million from rentals.

The board has leased 471,406 acres of Louisiana land during the past 4 years.

Texas Butadiene Calls Off Merger

OPPOSITION by owners of about 10% of the stock of Industrial Rayon Corp. has killed a plan to merge with Texas Butadiene & Chemical Corp.

After the opposition developed at an Industrial Rayon stockholders meeting in Cleveland, the Texas Butadiene directors in New York exercised their right last week to terminate the merger agreement.

President John D. Fennebresque of Texas Butadiene, who was slated to become president of the merged company, said that even though enough Industrial Rayon shareholders approved the merger, conditions were not favorable to proceed with the plan.

"A large number of stockholders of Industrial Rayon Corp. filed written objections to the merger and have the right to demand payment in cash for their shares under the Delaware appraisal statute," Fennebresque said. "It was the conclusion of the (Texas Butadiene) board that the cost of such payments would be so large as to make the merger no longer desirable."

Texas Butadiene has a petrochemical plant at Channelview, Tex., now expanding to a capacity of 120,000 tons of butadiene per year. It owns a 30% interest in a synthetic-rubber plant under construction in France and is negotiating to build a petrochemical complex in Argentina.

At the Cleveland meeting of Industrial Rayon stockholders, the vote was 1,362,705 shares (73.63%) in favor of the merger and 190,093 shares (10.3%) against it. The dissenters contended that the sale of Industrial Rayon stock to Texas Butadiene stockholders would give the latter control of the company. They also questioned data supplied on Texas Butadiene.

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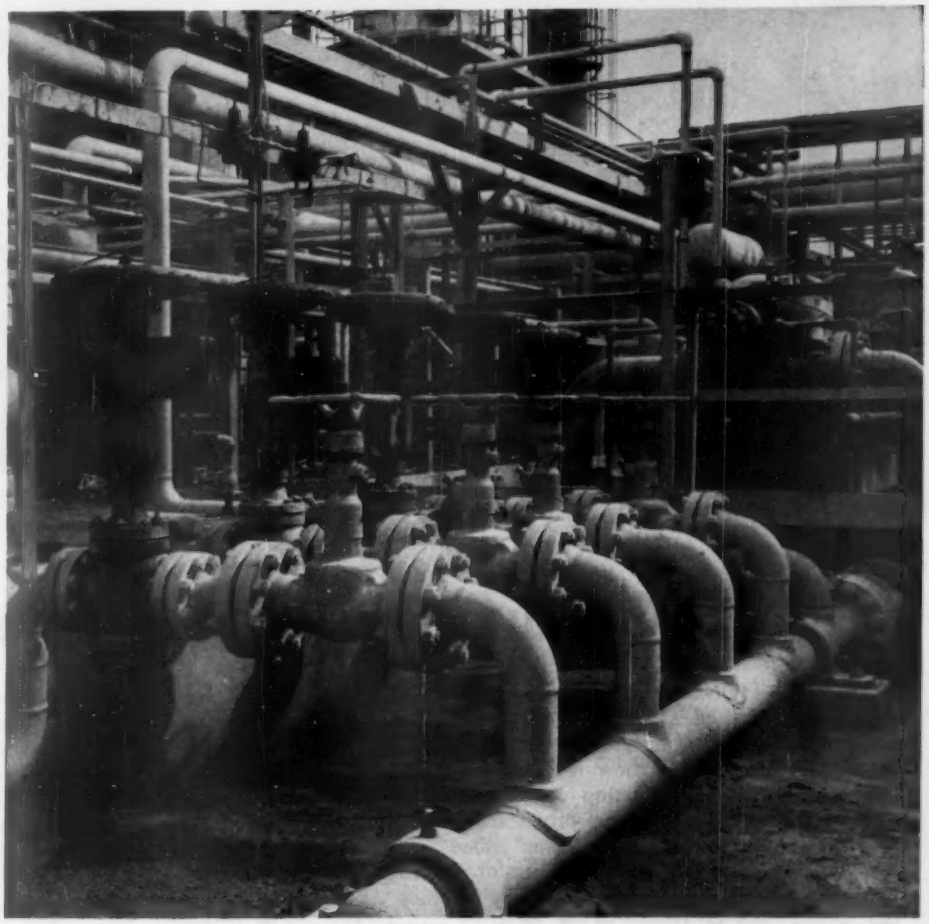

ORBIT VALVES installed as "stop" valves in a compressor installation at a large natural gasoline plant in Texas. Compressor is driven with rich oil from four absorbers.

The Orbit Valve's positive closure and non-lubricated feature is ideal for use with pressure regulators, meters, reflux pumps, compressors and similar equipment in areas where repairs must be carried out from time to time. Wherever Orbit Valves are installed, you are assured a safe atmosphere for dismantling equipment and do not have to worry about valve leakage that could create a hazardous working area.

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CONDUCTING one of the classes in petroleum marketing at the University of Tulsa is Prof. T. W. Coover. The school is the first to set up a 4-year program leading to a degree in petroleum marketing.

They'll Graduate Oil Marketing Men at

THE NATION'S only 4-year course in petroleum marketing—initiated a year ago by the University of Tulsa—already is having growing pains

The program, which now includes a heavy sprinkling of petroleum marketing courses and practical on-the-job experience, is being broadened for the next fall term. Several courses are being added.

The expansion indicates the success of the program, which was set up by Tulsa University officials with the advice and assistance of an industry committee of 19 men, most of them key members of oil-company managements.

Evidence of industry acceptance is the fact that many of the students taking the course are relatives of oil men. One student, who is working toward a master's degree, is on leave of absence from an oil company. (See opposite page.)

Enrollment already totals 40 freshmen and 33 students ranked as sophomores or above. All are shooting for bachelor of science or master's degrees in business administration with a major in petroleum marketing.

The marketing majors come from 13 states and three foreign countries, Japan, Egypt, and Indonesia.

The program . . . M. M. Hargrove, business-administration dean, says changes will be made in the curriculum effective with the September 1960 term.

A 2-year certificate in petroleum marketing, announced last year, has been dropped. The program now consists of a 4-year program leading to a bachelor's degree and a 5-year program for a master's degree.

Dean Hargrove says courses being added to the program include geology, transportation, credits and collections, and business communication.

The program currently includes courses on the principles of marketing, economics, cost accounting, advertising, business statistics, petroleum marketing outlets, selling petroleum products, sales management, business finance, personnel management, business cycles, and law of trade.

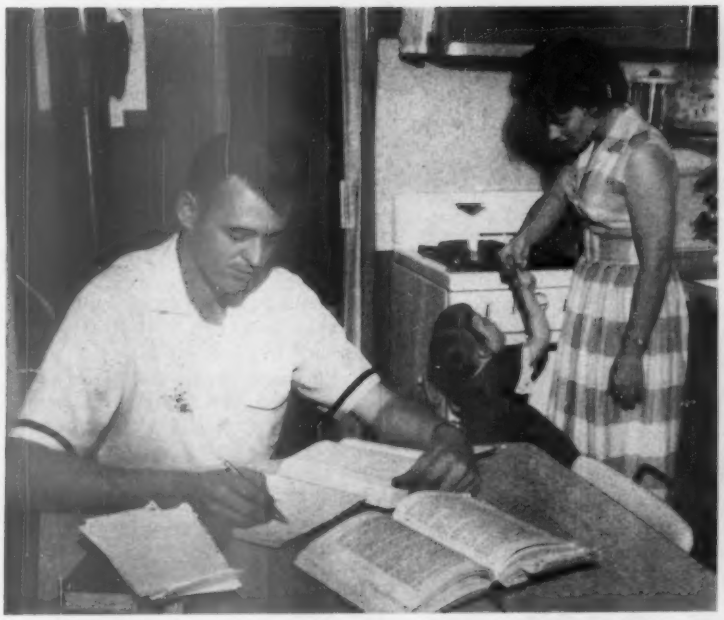
In dropping the 2-year certificate in petroleum marketing, Dean Hargrove says, "The oil industry generally, the students, and the university are in agreement that a 4-year degree in oil marketing should be the minimum goal."

In addition to the required courses, several hours are reserved for electives. "This permits a student to specialize in a related area of marketing, which might be in the field of science, engineering, or accounting—all of which are important to the marketer of tomorrow," Dean Hargrove says.

"The student completing the 5-year course has the assurance he is receiving the most comprehensive and advanced training offered in the field of petroleum marketing. He is equipped to deal intelligently with every business situation he may encounter in this field."

Practical experience also is a part of the program. The university encourages students, beginning with the sophomore year, to work 30 hours a week in some phase of marketing, such as a service station, selling, or in a warehouse. Job placements are arranged by the university.

Industry committee . . . The university is keeping the



STUDYING in the kitchen of his trailer home is TU marketing major Norman Eitemiller of Chadron, Neb., with his wife and daughter nearby.

SERVICE-station job adds practical experience to Eitemiller's classroom work.

Tulsa University

program abreast of the times by continuing to seek advice and recommendations from the industry committee which helped set up the course.

Members of the petroleum marketing general committee, representing the oil industry, include:

C. F. Gardenhire, Texaco Inc.; Ed E. Oberholtzer, Gulf Oil Corp.; Ed Loosley, Continental Oil Co.; Paul Vaananen, Skelly Oil Co.; O. E. Bean, Sinclair Oil & Gas Co.; R. D. Phillips, Pemco Oil Co.; W. W. Wingate, Du Pont; R. A. Douglass, Ethyl Corp.; W. W. Bryan, Humble Oil & Refining Co.; James Kemm, Oklahoma Petroleum Council; and Jack Heath, representing jobbers, all of Tulsa.

L. G. McKinney, American Petrofina Co. of Texas, Dallas; G. C. Richardson, Cities Service Oil Co., and Pat Smittle, Phillips Petroleum Co., both of Bartlesville.

John Dewell, Champlin Oil & Refining Co.; E. C. McIntosh, Knox Oil Co.; Donald Smith, Mobil Oil Co.; W. M. Murray, Kerr-McGee Oil Industries, Inc.; and E. K. Ketcham, Anderson Prichard Oil Corp., all of Oklahoma City.

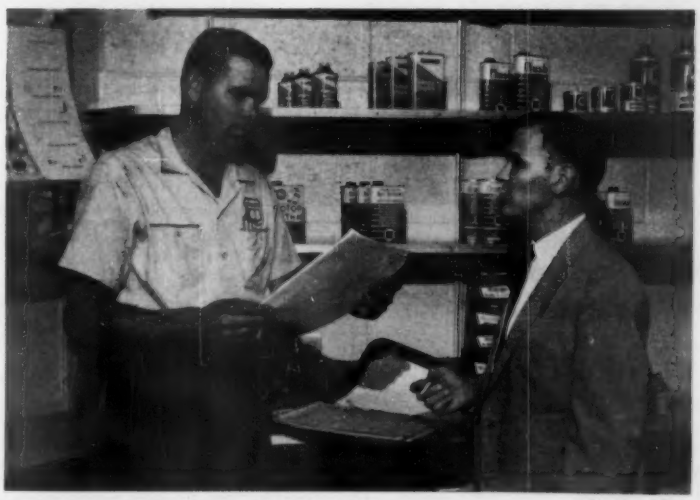
First Masters Within Reach

A UNIQUE scholastic achievement—the first master's degree in petroleum marketing—next August will belong to George W. Deeter of Lafayette, Ind.

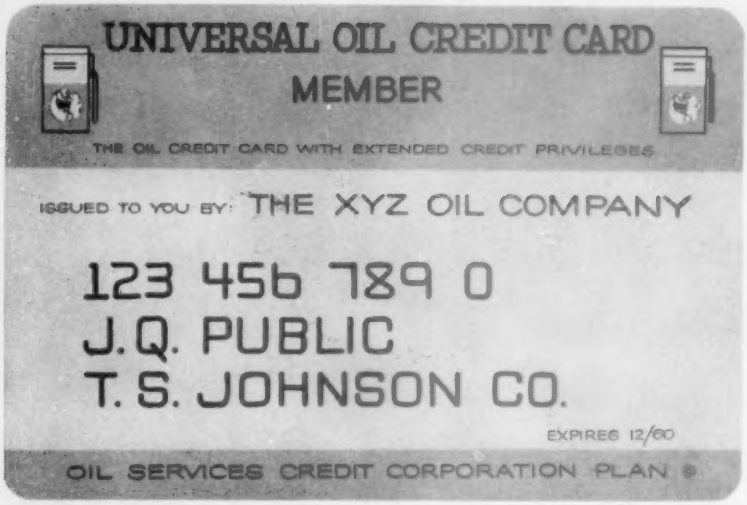
The 28-year-old employe of Continental Oil Co. will receive the degree from the University of Tulsa, the first university to offer a 4-year course in petroleum marketing.

Deeter is married and has two children. He has a bachelor of science degree in sales and merchandising from the University of Indiana and is on a year's leave of absence from Continental.

Deeter's master's thesis is a study of service-station operations.



INTERVIEWING service-station operator is George Deeter, right.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OIL SERVICES CREDIT CORPORATION PLAN ®

UNIVERSAL CARD may be held by millions of gasoline buyers by this time next year. It features both the Universal name and that of the participating company.

New Credit Approach

. . . will soon get rolling as companies sign up for service to handle all credit business. It's object: Cut costs.

A UNIVERSAL oil credit card will be in circulation by January 1.

Three major companies already have agreed to participate in such a program. Seven other majors are now studying the proposal, and four regional marketing firms have agreed to participate subject to minor qualifications.

The program will be administered by Oil Services Credit Corp., of Chicago, which has been developing and selling its plan for several months (OGJ, Dec. 28, 1959, p. 73).

"Within 60 days specific plans for getting the credit card in operation will be crystallized," M. S. Weeks, executive vice president of Oil Services Credit said last week.

The company has been studying oil's credit problems for 14 months. It has revised its original proposal several times to include suggestions from oil companies.

As now proposed, the plan calls for OSCC to screen potential customers, check their credit, and issue the cards. For a fee, it will also handle consumer advertising programs.

The credit firm's income would be a percentage of sales, the rate to be determined by average volume.

Cost cutter . . . Principal reason for the plan is its promise of cost reduction.

A Journal study last year disclosed that oil-company credit costs had trebled in the past 10 years, with indications that they would continue to climb (OGJ, Sept. 14, p. 65).

OSCC officials believe their operation will "eliminate at least 50% of present credit costs" within the first 3 years.

There are other advantages, too, in a universal card, they say. The plan is expected to:

. . . **Eliminate duplication** of cards. Most motorists now carry a number of oil-company cards. Under the new plan, a customer would get only one, and it would cover all companies participating.

. . . **Increase sales** by making the card negotiable nation wide. Regional marketers could benefit by picking up business of traveling motorists from other areas.

. . . **Eliminate duplicate** billings which now occur when purchases are made by a customer at stations of different companies.

"Oil companies have indicated they want to change this costly credit expense, and we; in complete earnestness, know it can be accomplished," says Weeks. "Our plans are not revolutionary, but merely the application of modern accepted methods that will not in any manner jeopardize the member companies in their present marketing relations."

Part of the cost cutting is expected to result from an "extended credit" charge, similar to that being adopted by most department stores. This permits a customer to delay payment of an account, but only by paying a service charge for extending payment beyond 30 days.

The Men Behind the New Credit Organization

FOURTEEN Chicago industrialists are officers and directors of Oil Services Credit Corp., formed early in 1959. They are:

Ralph W. Applegate, president, Casualty Mutual Insurance Co. and director of 10 other engineering, building, and bottling corporations.

Robert Arnold, president, Arnold Engineering Co., a subsidiary of Allegheny Ludlum Steel Corp.

Arthur S. Bowes, chairman of Maloney Crawford Tank & Manufacturing Co. and director of Minneapolis-Moline Corp. and Chicago, Milwaukee & St. Paul Railway.

Donald F. Bowey, director of Mid-America National Bank and Upper Avenue National Bank, Chicago.

Colin L. Campbell, president, Casualty Development Corp.

Samuel A. Culbertson II, vice president and secretary, Murine Co., Inc.

Walter Cruttenden, Sr., senior partner, Cruttenden, Podesta & Co., and a director of Securities Acceptance Corp. of Omaha.

J. Arthur Friedlund, director and general counsel, American Furniture Mart Corp. and Automatic Canteen Co. of America.

Edward J. Hutchens, director, Chicago Regional Port District Authority, and president and treasurer, Utility Manufacturing Co., Cudahy, Wis.

Hays MacFarland, director, Zenith Radio Corp.

Michael R. Notaro, director, Central National Bank, Chicago, and president, Statistical Tabulating Corp.

Roy Tuchbreiter, chairman, Illinois State Bank, Chicago; vice chairman, National Fire Insurance Co. of Hartford, and chairman of Continental Casualty Co., Continental Assurance Co., Transportation Insurance Co., and United States Life Insurance Co. of New York.

Hamilton Vose, Jr., president, Berkshire Papers, Inc., and director, Haywood Publishing Co.

Roger Q. White, president, Twin Cities Servisoft Corp., and director, Industrial Ceramics, Inc.

USI Axelson PUMPING NEWS

Multiple Completions Up 65%
Axelson Expands Special Products

2-ZONE PUMPS

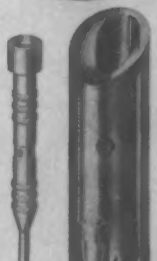
TWO-PACKER SINGLE STRING

Cross-Over Assembly

Least expensive for dual zone completions

SINGLE-PACKER DOUBLE-STRING

Clamped Tubing Cross-Over and Stab Joint Cross-Over Assembly



Most widely-used Axelson Two-Zone Pump, allows treating or gas venting the upper zone

ONE-PACKER TRIPLE STRING

Clamped Tubing Cross-Over

Used where the lower zone presents gas or corrosion problems. Both zones may be vented or treated.

As early as 1953 Axelson had a well-established Two-Zone Service Department when Texas was averaging less than 300 multiple completions per year. Now, with multiple completions up 65% over 1958, and running as high as 2200 per year in Texas, Axelson continues to expand its staff of full-time field specialists and engineers to handle the upswing of this type of completion.

Much has changed. Completions that once presented problems and seemed impractical are now considered routine due to Axelson's experience and advanced engineering design. Past complexities have been simplified and Axelson's know-how, specialized equipment and experience are available to all. Axelson's Two-Zone Department, now called **Special Products Department**, covers every multiple zone producing field in the United States and deals with both new completions and existing installations. They are also available to make recommendations on triple completions and slim hole duals or any phase of special multiple completion engineering.

Although their primary function is designing setups for multiple zone completions to take advantage of the production economies afforded by Axelson Two-Zone Pumps, Axelson experts work out production problems and make recommendations where one zone may be producing gas and the other oil, or where one zone is flowing and the other is pumping.

Axelson Two-Zone Pumps provide a practical, economical method of producing from two zones at once without commingling the fluids. Only one surface pumping unit is required, with a single rod string. All pump parts, with the exception of the cross-over assemblies, are standard, field proved parts, and the Two-Zone Pump itself is an insert-type pump, completely retrievable. A metal-to-metal seal is used for long life and dependability.

While the pumps themselves might be termed standard units, no multiple-zone completion can be called standard. No two wells present the same conditions, so each Axelson dual zone installation is in effect custom designed.

When an Axelson two-zone specialist is called in to discuss a multiple zone installation, he takes into account: pump depth (for both zones), casing size and length, tubing, water cut, gravity of the oil, desired production and the gas/oil ratio. The surface pumping unit—peak load and torque ratings, stroke length and maximum cycle, size—also enters the calculations, as well as such special conditions as sand, viscous fluid, and corrosion. He can also recommend the best tubing string design, the prime mover, surface pumping unit, packer type and rod string.

When the installation is made, he will supervise it at no extra charge—set the pumps and packers, and be on hand for the initial pump running—to make sure you have an efficient, economical production setup.

Call in your Axelson specialist and let him work with you in engineering your multiple zone installations. If you are contemplating a multiple zone flowing well, the Axelson specialist can install the correct cross-over now—and you won't have to pull tubing when you run the two-zone pump later!

Write the **Special Products Department**, Axelson Div. of U. S. Industries, 6160 S. Boyle Ave., Los Angeles 58, Calif.

SPECIAL NOTICE

For deep and/or high volume two-zone production Axelson announces a new special two-zone pump to run under a 26-ft. hydraulic pumping unit. Write for more information on this type of installation.

Write, Today, for New Facts

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- ☐ Two-Zone Pump
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- ☐ Long Stroke 2-Zone Pump

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COMPANY_____

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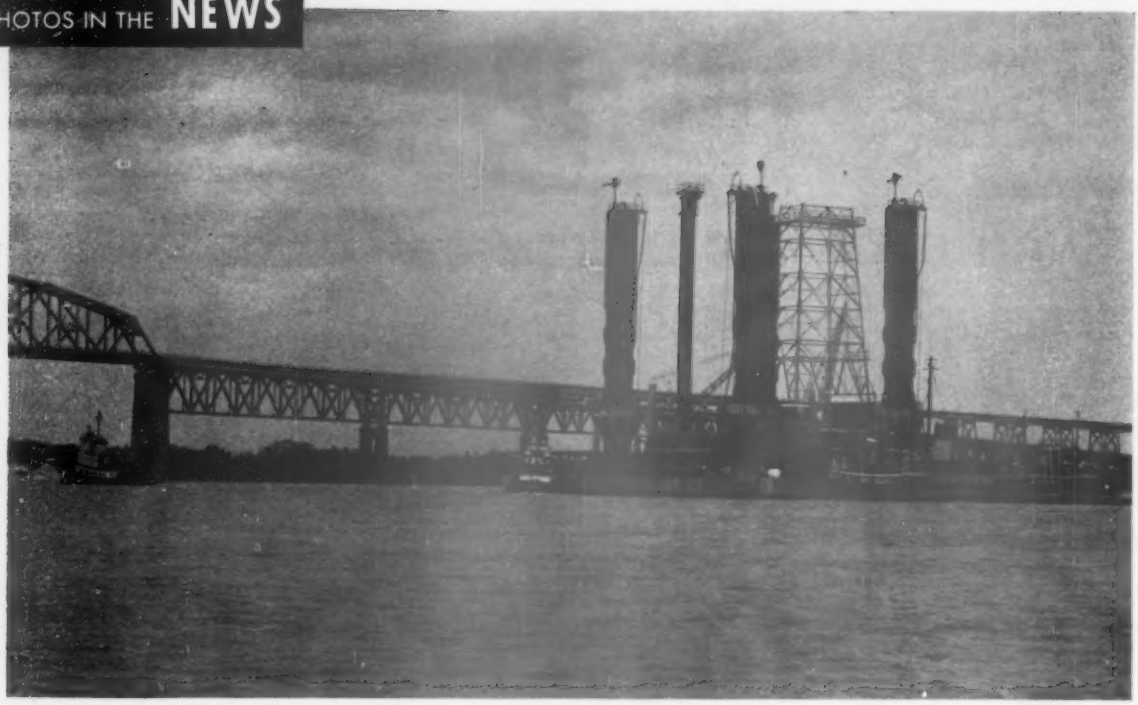


Floating Down River

THE S-66 offshore drilling barge, nursed by six tugs with their bows headed upriver, moves down the Mississippi to a location in the Gulf of Mexico for testing. In the background is the Huey Long Bridge. The barge, designed for drilling in 100 ft. of water, was built by Avondale Marine Ways, New Orleans. It is owned by Barge Facilities, Inc., San Francisco, and is under lease to The California Co.

Stringing Chopper

THIS UNUSUAL method of stringing pipe with a helicopter was tested by Transcontinental Gas Pipe Line Corp. in a swampy area near Kaplan, La.

Joints weighing 3,383 lb. were successfully strung in this manner. Petroleum Helicopters, Lafayette, La., furnished a Sikorsky plane with a 53-ft. rotor for the job. The helicopter can carry a joint of pipe weighing as much as 4,000 lb.

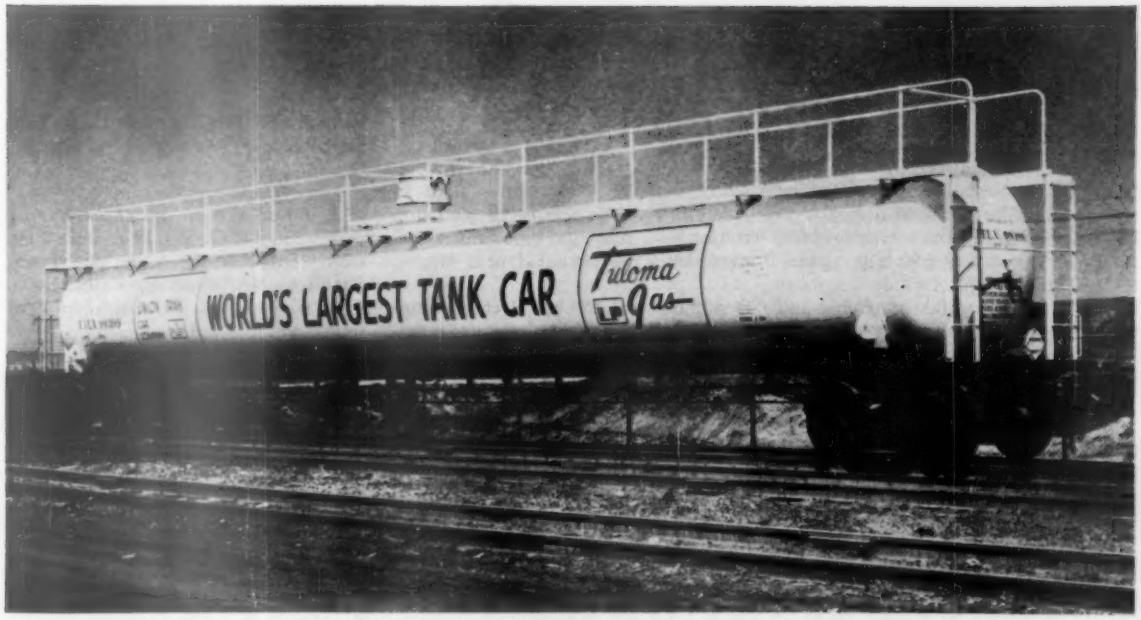
In this demonstration the average stringing time per joint was 3 minutes. Estimates for stringing pipe from the air on this type of right-of-way put the cost at about 35 cents per foot of pipe. Doing the job from ground costs between 75 cents and $1.

Skirted Structures

STEEL SKIRTS were installed on these two Shell Oil Co. offshore gathering platforms to give them greater stability.

The new wrinkle is a development by Shell engineers and has been put to use in the South Pass Block 27 field at the mouth of the Mississippi River.

The skirted section is sunk into the silt of the Gulf of Mexico and serves as a strong anchor. Each platform will serve 20 to 30 oil wells. J. Ray McDermott & Co., Inc., constructed the platforms at Morgan City, La., and installed them.



A Superlative Sausage

THE CAPACITY of this giant sausage-shaped tank car is 30,000 gal. It is over 85 ft. long. The owners, Tuloma Gas Products Co., Tulsa, say it will hold 8,300 gal. more than the next largest railroad tank cars being used in interchange service. The car was designed and constructed by Union Tank Car Co. It weighs 108,200 lb. when empty.

Leasing Off California Could Get Tangled

- The state plans to put up 48,000 acres off Santa Barbara County. The switch from statute miles to nautical miles means problems if federal Government wins the tidelands dispute.

CALIFORNIA'S decision to lease additional offshore parcels could lead to some complications down the road.

The state plans to put up for leasing some 37,000 acres in nine parcels off Santa Barbara County which were requested by Shell Oil Co. (OGJ, April 11, p. 88). California also will offer an additional 11,000 acres on its own hook.

The hitch may develop later because both the Shell request and the state's voluntary offering specify offshore distances in nautical miles instead of statute miles.

This stems back to the dispute between California and the federal Government over where the limit of three "geographical" miles, set out in the Submerged Lands Act, applies off California.

Briefly, the state claims it has jurisdiction 3 miles seaward of the channel islands, and that it owns all submerged lands between the islands and the coast—a distance of more than 50 miles in some places.

The Government contends the state's jurisdiction extends only 3 miles seaward from the coast and 3 miles around each of the islands.

The use of the 6,080-ft. nautical mile instead of the 5,280-ft. statute mile in the new lease offerings is seen as a move by the state to strengthen its hand in the tidelands dispute.

The parcels to be offered for leasing are located at the ends and between existing parcels A, B, C, D, and E, which were awarded on the basis of statute miles (2 miles wide and 3 miles seaward).

So, if the new parcels are based on nautical miles, there will be a narrow strip of unleased state-owned land seaward of parcels A through E.

If California wins the tidelands hassle, there will be no problem over the difference in size of the parcels. But, if the Government wins and it's decided the U. S. owns all submerged lands outside the three-statute-mile limit, some costly revisions in the leasing would have to be made.

Added acreage . . . California apparently added the 11,000 acres to the lease sale to prevent the military from restricting oil operations in any additional tidelands acreage.

The 11,000-acre tract lies west of Parcel E and is within a couple of miles from the southern edge of the Pt. Sal-Jalama Creek area, presently restricted because of Vandenburg Air Force base and the Navy's Point Arguello missile installations.

The Navy has officially disclaimed any plans to extend its missile range safety jurisdiction beyond Pt. Conception, but some state officials still aren't convinced.

Hearings on tap . . . The State Lands Commission has scheduled a hearing May 31-June 1 in Los Angeles to determine what bid technique will be used in the new lease offering.

State law provides offshore leases can be awarded on the basis of royalty, cash bonus, or a combination of the two.

The hearing is expected to touch off some verbal fireworks because of the differences of opinion among oil men on which method is the best. Odds right now seem to favor the cash-bonus method as being selected.

The commission also will hold another hearing, probably around June 1 in Santa Barbara, to consider any objections to the lease offering.

PIPELINE BRIEFS . . .

Extension of the Ajax Alberta Pipeline, Ltd., transmission line is planned from Morinville to the Westlock Viking gas field in Alberta. The field has reserves estimated at 250 billion cubic feet. The line will include 28 miles of 10-in. and 4 miles of 8-in., and will primarily serve industries in the Edmonton area. Completion is planned by September 1961.

Contract to lay a 75-mile 30-in. line from Troy Grove underground storage to LaGrange, Ill., for Northern Illinois Gas Co. has been awarded to Contracting & Material Co., Evanston, Ill. Construction on the $10-million project will start this week and completion is scheduled for early fall.

Construction has begun on a 42-mile 6-in. LPG line by Texas Pipe Line Co., which will own the line in equal undivided interests with Tidal Pipe Line Co. Contract was awarded to M. L. (Jack) Moore Construction Co., Odessa, Tex. The line will extend from the New Hope plant in Franklin County, Texas, to Nettleton station on Texas Pipe Line's main line. Completion is scheduled next month.

A modern 2,400-hp. electric pumping station that can be operated unattended will be installed at Raceland, La., replacing the present Interstate Oil Pipe Line Co. station, which has 11 gas-engine-driven pumping units. The station was built in 1943 with three pumping units and has grown with production in coastal Louisiana. Completion is planned about September 1.

A 60-mile 8-in. products line is being laid by Great Lakes Pipe Line from Grinnell to Waterloo, Iowa. Shamrock Construction Co., Dodge City, Kans., has the main-line contract.

Completion of a 61-mile 6-in. products line from Hull to Beaumont, Tex., is scheduled next week by Mobil Oil Co. The line was contracted to Panama, Inc., Houston.

Also for Pipeliners . . .

IN THE NEWS: New appointments may mean further delays in FPC cases (p. 97) . . . Pipeline executives and engineers say automation is paying off, but there are many headaches in personnel and training (p. 114) . . . TGT acquires new reserves along the Gulf Coast (p. 115) . . . Canadian gas-import plan clears FPC hearing examiner (p. 116).

A complete list of pipeline projects is carried in the last issue of each month. Current projects are covered in Pipeline Briefs.

PLUS THIS SPECIAL REPORT: How natural gas moved in 1958 (p. 180).

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Pipeliners Say Automation Pays Off, But

• Platte pipeline is proof automation can save money, but semiautomation is the best bet for some lines. Several approaches have been adopted in easing the layoffs resulting from pipeline automation.

AUTOMATION is paying off for the pipeline industry, but it is also reaping a harvest of personnel displacement and training headaches that will be around for some time.

The joys and woes of automation were aired by a blue-ribbon panel of executives and engineers at the annual pipeline conference of the API Division of Transportation in Tulsa.

Automation economics . . . The payoff from remote control was exemplified by Platte Pipe Line Co., a crude system out of the Rocky Mountains which was designed as a dream of young pipeliners.

Completed in 1953, the 1,000-mile system began automatic operation in 1954. Eight of the 11 stations were automated; during the shakedown period, there were 36 operators compared to 48 had the line been fully attended. Here are the dollars-and-cents results of automation:

. . . 1954—lost $13,000 per month, compared to fully attended operation.

. . . 1955—lost $8,000 per month. The number of operators was cut to 20; one station was added to gain increased throughput.

. . . 1956—gained $2,000 per month. Operators were reduced to 12 compared to 55 with this number of stations manually operated.

. . . 1957—gained $10,000 per month. Ten operators were used, compared to 61 under manual operation; two stations were added.

. . . 1958—gained $13,000 per month.

. . . 1959—gained $14,000 per month.

. . . 1960—prospects are still better. Greater savings are indicated from further centralized control.

With older systems, however, automation must be gradual. An API survey showed last year that 20% off all U. S. crude and products stations were remotely controlled; 12% were unattended. Most new stations are planned for remote control.

But most pipelines have been concerned with partial automation of existing lines. Some of these have found far better payout from semiautomation, such as installing automatic oiling, temperature sensing, and other devices while still keeping local operation. This has been a good means of cutting operating costs for a minimum outlay, the panel said.

Layoffs . . . With technical progress have come great human problems, and these have been handled in a variety of ways.

One company reduced its personnel by 400 in 2 years. It inaugurated liberalized early retirement, voluntary termination allowances, and tried to absorb others in the pipeline or other company departments.

After these steps, layoffs followed.

Service Pipe Line Co. set up a program to find jobs for surplus employes displaced by modernization.

Sun Pipe Line Co. used early retirement and transfers to other departments, but drew the line at wholesale firings. Sun doesn't automate any faster than it can take care of personnel.

The importance of informing employes of automation plans was emphasized by panel members. Some companies let employes in on plans from the earliest stages and keep them posted until the project is actually started. They are told, station by station, the economic reasons for automation.

This doesn't make them happy

Panel Members

In the left photo, left to right, are: H. M. McDonald, vice president, Texas Eastern Transmission Corp.; W. J. Wilkins, president, Laurel Pipe Line Co.; P. D. Phillips, Jr., vice president, Humble Pipe Line Co.; E. W. Unruh, president, Sinclair Pipe Line Co.; A. E. Heidebrecht, manager of operations and engineering, Platte Pipe Line Co.; L. W. Ewing, Jr., chief engineer, supply and transportation department, Standard Oil Co. (Ind.), moderator.

In the right photo, left to right, are: H. W. Pattison, manager, transportation department, Standard Oil Co. (Ohio); G. G. Billings, manager of operations, Shell Pipe Line Corp.; W. K. Borland, chief engineer, Plantation Pipe Line Co.; R. C. Reilly, chief intsrument engineer, Phillips Petroleum Co.; Ralph Troseth, assistant general manager, Texas Pipe Line Co.; C. R. Elder, Jr., general superintendent, Sohio Pipe Line Co.; and D. R. Merriman, assistant to the vice president, Buckeye Pipe Line Co.

Creates Problems

when they are out of a job, but they at least understand and accept the situation better. High-level executives talk to individuals affected to explain the need for modernizing.

Training problems . . . Pipelines are faced with major training problems.

Pipelines with manned stations used to have built-in automatic training programs. Men progressed from lesser to greater assignments on the pipeline, some of them into management. Now that training ground is gone.

The men who are being absorbed into modernized systems must be upgraded. The first step is to train trainers to acquaint them with new equipment which is subject to continuous change. Manufacturers offer a certain amount of training.

Qualifications are set forth so that trainees know what is to be expected of them, and periodically they are checked to see if they will fit in with the new scheme of things. One company transfers personnel over its system to give them wide acquaintance with new machinery as it is installed.

Computers . . . Computers first came into pipelining through the business office, where repetitive operations lend themselves to machine handling.

But now engineering and economics departments are using computers extensively, and dispatching and scheduling problems are being solved by computers.

Shell Pipe Line Corp. is using computers for power optimization, new line studies, optimum line sizes, and for such complex and time-consuming jobs as designing heated oil pipelines.

Shell expects soon to add optimum use of tank-farm facilities to its machine repertoire. Whereas it has taken many weeks for one employe to analyze two uses of a tank farm, thousands can be checked by computer in a matter of hours.

Future automation . . . Steady progress toward the completely self-controlled pipeline, operated by a computer, is being made.

But there are obstacles, the panel pointed out. On a products line, for example, available batch interface detectors generally do not satisfy engineers. They aren't sure enough to use the instruments as the basis for making automatic deliveries to terminals. Pipelines report from 95% to 99% reliability.

One of the biggest needs for automation is in gathering in stripper areas. LACT has cut costs significantly where production is large. But little has been done for marginal high-unit-cost leases. Gathering costs vary from less than 1 cent a barrel to 15 to 20 cents a barrel.

If someone can develop a system to automate economically a 5-bbl.-daily lease, then a big dent can be made in the 15 or 20-cent gathering costs which eat into pipeline profits.

TGT Buys Gas Reserves for New Loop

TENNESSEE Gas Transmission Co. has acquired 3.2 trillion cubic feet of new gas reserves along the Gulf Coast of Texas and Louisiana to bolster an application to spend $46.2 million on expansion.

The company went to the Federal Power Commission last week with an application to add 191 miles of 36 and 30-in. looping to its existing system in Kentucky, Ohio, Pennsylvania, and New York.

Also it would install another 43,600 compressor horsepower at five new stations in Mississippi, Alabama, Kentucky, and New York, and at four existing stations.

The new facilities would add 160 million cubic feet daily of capacity for delivery to 46 customer companies from Mississippi to New England including the subsidiary Midwestern Gas Transmission Co. serving the upper Middle West.

The application is similar to one filed by Tennessee Gas several months ago in the form of an amendment to an FPC order. At that time FPC told the company to submit a separate application and make a full showing of gas supply for the expansion.

The company told the FPC last week it had 81 new gas-purchase contracts plus amendments to existing contracts and new reserve estimates of its own production. The new sources bring the company's gas reserves to a record high of about 18 trillion cubic feet.

The new contracts for gas were acquired at rates not exceeding the current market price.

Exhibits filed with the FPC showed Tennessee Gas will pay prices ranging from 15.9 cents to 22 cents per thousand cubic feet in Louisiana and from 15 cents to 19.6 cents in Texas.

Canadian Gas-Import Plan Tops Another Hurdle

A MAJOR project involving importation of Canadian gas for use in California and the Pacific Northwest has cleared the hearing examiner stage at the Federal Power Commission.

However, the plan must still be acted on by the full commission and may face further opposition at that point.

In addition, the California Public Utilities Commission is to decide in several weeks if it will withhold approval of the section of the project in that state. PUC attorney Harold McCarthy recommended the commission withhold approval pending a renegotiation of the producer contracts (OGJ, Apr. 25, p. 108).

The approval given by the FPC examiner contains certain conditions, principally affecting control of consumer prices "during the evolution of further Canadian regulation of producer and pipeline profits."

The project involves importation of Canadian gas by Pacific Gas Transmission Co.; El Paso Natural Gas Co.; and Montana Power Co.

Pacific Gas Transmission will purchase the gas from Alberta & Southern Gas Co. at the U. S.-Canadian border near Kingsgate, B. C., and will transport it to the California-Oregon border for delivery to the Pacific Gas & Electric Co. The latter will distribute and sell the gas in California. PG&E is the parent company of both Pacific Gas Transmission and Alberta & Southern.

Under the proposed plan, Pacific Gas Transmission will build a 36-in. line extending 614 miles from the Canadian border to the California border. It will supply PG&E with an average of 418 million cubic feet of gas daily.

Pacific Gas Transmission will also build a line to connect with the El Paso system to serve the Spokane area.

Montana Power will have 30 million cubic feet of gas daily delivered to it at Cutbank, Mont., by its subsidiary, Canadian-Montana Pipe Line Co., which will purchase the gas from Alberta Gas Trunk Line Co.

Export authorizations have been granted by both the Alberta government and the Canadian National Energy Board.

In approving the plans, the FPC examiner, Robert Weston, expressed concern solely over what might happen to prices.

He said he was approving the project on the grounds that initial prices were not out of line and on the possibility of future American-Canadian arrangements to afford continuing consumer protection.

Meanwhile, he said, a full report of facts on profits and prices would be published in annual reports to be made to the FPC so that further action could be taken, if necessary, to keep consumer prices from soaring as a result of unregulated field prices in Canada.

Resid Stocks Down, Imports Move Up

RESIDUAL FUEL oil imports into Districts 1-4 during the first 3 months of this year were 66% of the entire 6-month quota, the Interior Department reported last week. This includes the recent 12-million-barrel hike in total quotas for the allocation period.

Residual stocks at refineries, bulk plants, and terminals in East and Gulf Coast areas reported at 18,862,077 bbl. in March, compared with 32,864,600 bbl. in March 1959 and 24,016,400 bbl. in March 1958.

Imports by district for March, in barrels daily, were:

Districts 1-4—Crude and unfinished oil, 683,549; finished products, 37,047; residual, 556,867; and exempt crude imports from Canada, 69,408.

District 5—Crude and unfinished oil, 185,531; finished products, 7,687; and exempt crude imports from Canada, 47,518.

Puerto Rico—Crude and unfinished oil, 65,226; petroleum products 1,325; and residual, 1,009.

PROCESSING BRIEFS . . .

The world's largest propane deasphalter will be built at Sun Oil Co.s Toledo refinery. Construction of the 10,500-bbl. per day unit will begin in August, with completion next spring. The $3.6-million unit will use rotating disc contactors in three 9 by 70 ft. towers. It will boost cat feedstock and reduce residual-fuel production. Foster Wheeler has the contract for design, engineering, procurement, and construction.

A 500-bbl. UOP merox unit has been placed in operation at Pana Refining Co., Pana, Ill. The unit treats thermal gasoline by sweetening it and extracting mercaptan.

The carbon-black plant of J. M. Huber Corp. at Baytown, Tex., is being expanded to produce 60 million additional pounds a year. Two units are under construction. One is for intermediate super abrasion furnace black and the other will produce fast extruding and general purpose furnace black.

A joint venture in production and marketing of petrochemicals is being made by El Paso Natural Gas and Rexall Drug & Chemical. It includes construction of olefin, polyolefin, and chemical plants at Odessa, Tex. The first plants of the complex, to begin production in early 1962, will produce ethylene, propylene, conventional polyethylene, linear polyethylene, and polypropylene. Annual capacity of the olefin plants will be 200 million pounds. Combined annual capacity of the polyolefin plants will be 150 million pounds.

Installation of LPG facilities at Sinclair Refining's East Chicago refinery has been completed. Included are a unit for propane recovery, storage tanks, and loading platforms.

Also for Refiners . . .

IN THE NEWS: Depressed product prices cut sharply into most oil companies' first-quarter profits (p. 95) . . . Merger is off for Industrial Rayon Corp. and Texas Butadiene & Chemical (p. 104) . . . Nation's first oil-marketing school at Tulsa University is expanding (p. 106) . . . Universal credit card will start in oil industry by January 1 (p. 108) . . .

PLUS THESE TECHNICAL REPORTS: New joint makes precast concrete practical (p. 158) . . . How the digital computer works for Aurora (p. 170) . . . Amoco to modernize Texas City refinery (p. 178).

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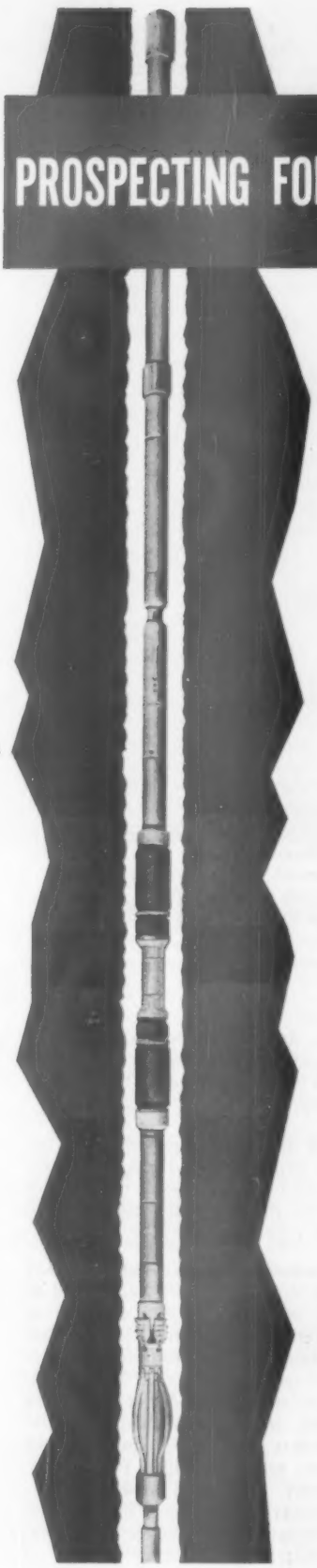

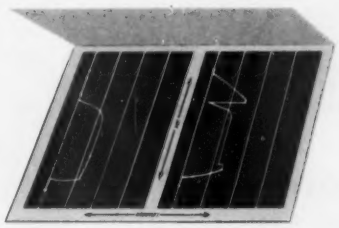

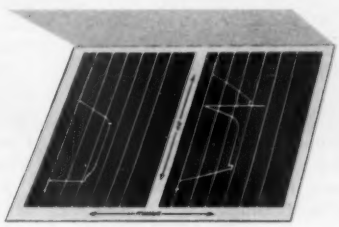

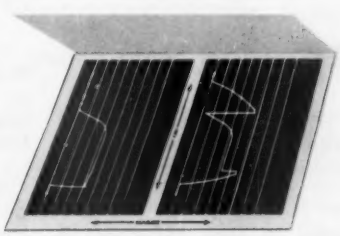

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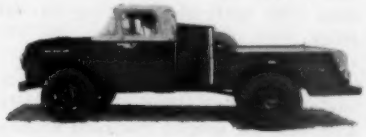


"FOR TESTING RESULTS . . . YOU CAN TRUST"

Kansans Ask Sharp Cut in Runs

. . . in telegram to 20 big refiners. Deteriorating market could force shutdown of Mid-Continent production, it says.

KANSAS independents have asked major refiners to "show some real industry leadership" and reduce "ruinously high refinery runs."

As an alternative they offer the possibility of a complete shutdown of Mid-Continent production.

In a telegram to 20 refiners, Tom L. Schwinn, executive vice president of the Kansas Independent Oil and Gas Association, said:

"The board of directors of the Kansas Independent Oil and Gas Association calls upon you to reduce your ruinously high refinery runs at once in order to prevent further deterioration of the domestic oil market. Responsible leadership in this regard is necessary on your part. Failure to act in this emergency may very well necessitate a complete shutdown of the entire Mid-Continent producing area."

It was addressed to the chief executives of American Petrofina, Ashland, Atlantic, Cities Service, Continental, Gulf, Humble, Mobil, Ohio, Phillips, Pure, Sinclair, Skelly, Standard of California, Standard of Indiana, Standard of New Jersey, Standard of Ohio, Sun, Sunray, and Texaco.

Commenting on the shutdown statement embracing the Mid Continent, Schwinn said that the possibility was one among those discussed at a meeting of the liaison committee of 14 associations in Denver. So far as he knows, he added, no other association in the mid-continent has acted upon the idea. He said such action is certainly a possibility.

Schwinn said that KOGA is calling attention to facts that everyone knows—that refiners have continued to operate at capacity, that product prices have turned soft, that price weakness is now beginning to affect crude prices.

"In Kansas alone," he said, "there are six deviations from regular prices, and in Texas the so-called 'adjustments' have almost abolished posted prices."

"The Mid-Continent," he said, "is carrying the load on this. None of the other states is cutting back."

Schwinn said that KOGA does not feel that the smaller refiners are taking a significant part in over-producing. "It's up to the majors to set the pace on this and show some real leadership."

"By focusing national attention on the problem, we hope to get action."

Williston Basin Line Approved

A NEW North Dakota crude line has won the approval of the State Public Service Commission.

The 118-mile line will be built by Great Northern Railway Co., St. Paul, Minn. It will connect 39 fields in Burke, Bottineau, Divide and Renville Counties, to a railhead at Minot.

Scheduled for completion before next winter, the line will cost $3,205,000. It is planned to extend it into Minnesota when markets and reserves justify the expansion.

The commission also approved a $625,000 pipeline gathering system to be built by Northwestern Refining Co., St. Paul, in Rival and Lignite fields.

One other North Dakota crude line has been proposed and another is expected to be detailed before the Canadian Senate soon.

Matador Pipe Line Corp. would move crude from the state's northern counties to Cromer, Man., and tie in with the Interprovincial pipeline. From Cromer the oil would flow to the Twin Cities.

The Canadian Parliament has approved Matador's plans, which are now pending before the Canadian National Energy Board.

Northern Pipe Line Co. is expected to present plans to the Canadian Senate for a line from Regina, Sask., to Clearbrook, Minn., for a tie-in with Minnesota Pipe Line Co.'s system.

Details of the proposal and the interests involved have not been made public.

INDUSTRY BRIEFS . . .

Frank O. Prior, chairman of the board of Standard Oil Co. (Ind.), plans to retire August 25 when he reaches the age of 65. Prior announced his retirement plans at Indiana Standard's annual meeting last week. He indicated the chairman's post will not be filled. John E. Swearingen, president of the company, will become chief executive officer.

Phillips Petroleum Co. plans 75 new retail gasoline outlets in Ohio this year, with 25 already under construction. Phillips entered the Ohio market a year ago and now has more than 100 stations operating in 60 cities.

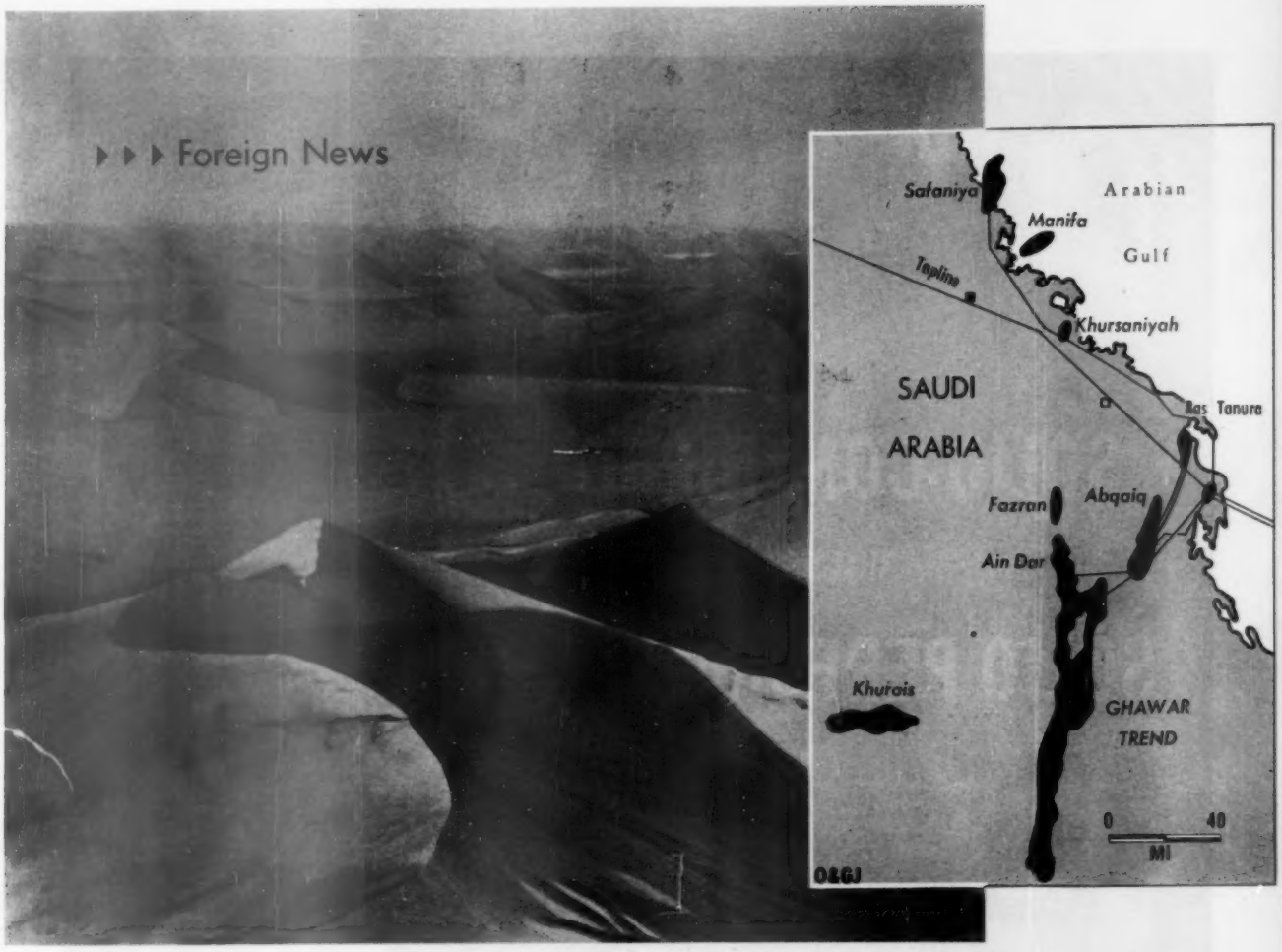
Stanton Oil Co., Ltd., San Antonio, has paid various sellers approximately $500,000 for several thousand royalty acres in Cochran County, Texas. The acreage is near producing leases recently acquired by Stanton from Sapphire American Petroleums, Inc., Toronto.

Properties of Slick Oil Corp. in three Texas counties have been sold to Tennessee Gas Transmission for approximately $1.2 million. Included is Slick's interest in 12,300 acres in Starr County and a half interest in three oil wells and six gas wells there. In Webb and Zapata counties, the properties consist of a half mineral interest in Slator Ranch, covering 17,712 gross acres.

Continental Oil has paid approximately $3 million for oil properties owned by W. F. Turner, Ardmore, Okla. The properties consist of 56 oil wells on 16 leases in Oklahoma and Texas. They are in Velma, Brock, and West Hewitt fields in Carter and Stephens counties of Oklahoma and in East Texas field, Gregg County, Texas.

The Houston Petroleum Club, located atop the Rice Hotel, will move into the top two floors of the 44-story Humble building when completed in about 2 years.

Turnover of service station dealers in 1959 totaled 27.6%, compared to 27% in 1958, the API Division of Marketing has reported. Of the terminations, 7.6% were beyond control of the supplier or dealer. Reasons included retirement, death, military service, and highway changes. Turnover was greatest in small volume stations selling less than 100,000 gal. annually. More than one-half the terminations were among dealers with less than 1 year's service station experience, the API survey showed.



Aramco Developing Big Reserves in Two Fields

• Work at Khurais and Manifa fields adds 2 billion barrels to company's reserves. This year's plans include opening of Khursaniyah field.

TWO MAJOR new oil fields are shaping up under development drilling in Saudi Arabia.

Field work at Khurais field, about 70 miles west of Ghawar field indicates an oil pool about 50 km. long and 13 km. wide, or 31 by 8 miles. Manifa, a young Persian Gulf offshore field is not yet fully delineated, but the oil accumulation is at least 22 km. or 13.6 miles long.

Arabian American Oil Co. in its annual report this week says drilling in these and other areas last year disclosed additional reserves of 2 billion barrels, over and above withdrawals. The company estimates its proved recoverable reserves at year end at 38.6 billion barrels.

Aramco completed six development and an observation well in the 4-year-old Khurais field. One well, Khurais 4, was plugged back from 13,560 ft. after the Khuff formations proved unproductive. It was completed as a producer in the Arab-D member. Two delineation wells were abandoned. The field now has nine shut-in producers.

Three producers were completed at Manifa from the mobile drilling platform "Queen Mary." The field now has five shut-in producers, with the northern side of the proven productive area about 16 miles southeast of the southern edge of Safaniya offshore field.

Another structure, Fazran, lying immediately north of Ghawar, is at least 12.5 miles long and 1.8 miles wide. It has not been fully defined on the northeast.

New production . . . Khursaniyah field, which has a 22-in. pipeline from Safaniya field to Ras Tanura conveniently running through it, will open this year with an initial capacity of 45,000 bbl. daily.

The field has five shut-in producers and two observation wells. The pay is 6.8 miles long and 4.3 miles wide. The pipeline will be able to move up to 190,000 bbl. daily of either Safaniya or Khurais crude to Ras Tanura.

Of the 350 wells drilled by Aramco over the years, 201 are producing oil and two are producing gas. Another 72 wells are shut in on standing producers, 22 are used for observation, and 18 for water or gas injection. Four wells have been suspended, 28 abandoned, and three were drilling at the end of the year.

The company's 1,095,399 bbl. daily crude production last year was a gain of 7.9% over the previous year's production.

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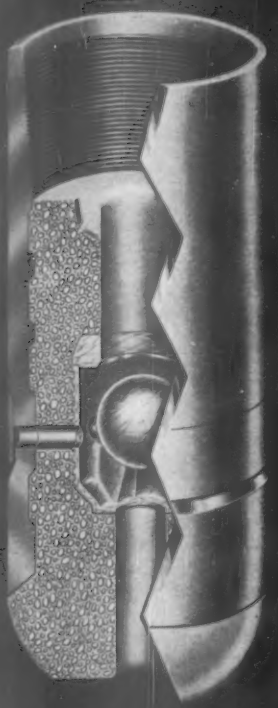

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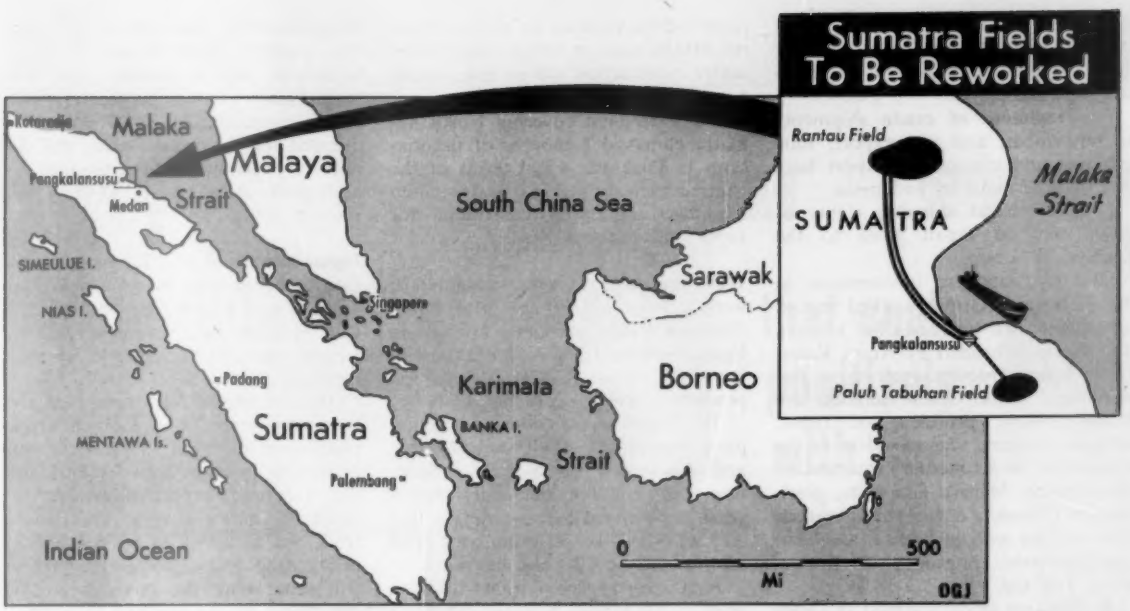

Japanese Get Another Source of Foreign Oil

• A new company will rejuvenate two Indonesian fields. Another company is developing an important strike in the Persian Gulf Neutral Zone.

THE JAPANESE are setting up a new operating company this month to handle crude production in North Sumatra under a joint development program with Indonesia.

North Sumatra Oil Development Cooperation Co., Ltd., will be formed in Tokyo on May 26. Japanese refining companies will have 30% interest; Japan Petroleum Exploration Co., (Japex), a semi-government corporation, 20%; shipping companies 10%; and other interests, 40%. Paid up capital will be $1.39 million. Hisayoshi Sato, former president of Mitsui Metal Mining Co., is expected to become president.

The company is being set up in line with an agreement signed last month by Col. Ibnu Sutowo, president of Permina, the Indonesian National Oil Co., and Kiichi Miura, president of Japex. The Japanese will advance $52.3 million to Permina to restore North Sumatra fields. Repayment will be made in oil over a 10-year period (OGJ, Apr. 18, p. 102).

The agreement marks the second success within months by Japanese to develop foreign sources of yen oil. The $52.3-million in equipment, material, and manpower will be supplied from Japan, and the crude repayments, therefore, will be 100% yen.

Another Japanese company, Arabian Oil Co. is developing an offshore field in Neutral Zone waters of the Persian Gulf. Two wells in the 6,000-bbl.-daily class have been brought in so far. This crude will be partially yen and partially dollar oil. This is because Arabian Oil Co. will have to take dollars only for that part of its revenue earmarked as the profit split for Kuwait and Saudi Arabia, the owner countries.

A CHECK is made of an Indonesian well by a native worker.

North Sumatran production will come from fields never returned to Royal Dutch-Shell after World War II. There are about 200 wells in the area. Fifty are on production with an output of 13,700 bbl. daily.

Highlights of the Japanese-Indonesian agreement are:

... **Repayment** of the $52.3-million loan to start next year with the Japanese taking 40% of production over existing levels. When production exceeds 43,000 bbl. daily, Japan's share will be negotiated.

... **Guarantee by Permina** that total

value of crude shipped will be worth at least $52.3 million. This protects the Japanese in the event of sharp cuts in crude prices.

... **Treatment of crude** shipments as repayment, and not export, thus avoiding any changes in export laws that may be made by Indonesia.

... **Preferential shipping** rights of crude sent to Japan given to the Kobayashi Group.

The top Japanese businessmen in the Kobayashi Group worked for an agreement with Indonesia for 3 years. The group is headed by Ataru Kobayashi, former president of Japan Development Bank. Other members are Kiichi Miura, president of Japex; Kogoro Uemura, vice president of the Federation of Economic Organization (Keidanren); Shigeru Kinoshita, president of Kinoshita & Co., an influential firm trading with Indonesia; and Shojiro Ishibashi, president of Bridgestone Tire Co.

Bridgestone recently signed an agreement with British Petroleum for the purchase of LPG from Kuwait. The company now plans to import LPG from North Sumatra as well as from the Middle East. A refrigerated tanker under construction will go into service next year.

The agreement covering North Sumatra climaxed 7 months of negotiations in Djakarta. Final terms of the contract were ironed out by Hanemon Yoshida, enginering consultant for Japex, and Sutowo.

Wells shut in . . . There are about 170 wells in Rantau field, and 30 in Paluh Tabuhan. The producing depth in Rantau is from 1,300 to 3,900 ft., with about 20 oil sands. The 50 wells on production average 270 bbl. daily.

The Japanese are counting on complete restoration of all shut-in wells, and plan to drill 300 more. A production goal of 43,000 bbl. daily after 4 years is based on the assumption that 230 wells will be on production with each averaging 190 bbl. daily.

A 20-man Japanese team will soon leave for Indonesia to work out plans for the initial stages of the program. About $7 million will be spent in the first year for restoring facilities at Pangkalansusu. There are two 47- mile 6-in. pipelines from Rantau to Pangkalansusu, and a 10-mile 5-in. line from Paluh Tabuhan to the terminal.

An investment of $8.35 million is planned for the second year, and $7 million expenditures are planned in each of the next 2 years. Drilling will start in 1961.

Japanese pleased . . . Tokyo businessmen feel they have made a good bargain. The crude is of good quality, 48.5°-gravity, paraffinic base, and the freight cost will be much lower than from the Persian Gulf.

The volume of oil returned on the loan will hinge on prevailing crude prices over the next 10 years. Details of pricing have not been revealed. But the Japanese expect shipments to reach 35 million barrels. This would work out to about $1.50 per bbl. If prices drop badly, however, Permina will renegotiate the contract so the repayment of the yen loan is assured. If the loan is not repaid during the 10-year period, the final adjustment will be made in the eleventh year.

New French Marketing Company Stirs Fears

• Private interests are afraid discriminatory measures will give bigger share of the French market to the government-controlled firm.

DESPITE the marriage of Caltex interests in France to a new government-controlled company, other local companies fear the government's move into local markets is just starting, and not ending.

The pessimism remains despite a promise by the government that a new company based on Caltex facilities will not be granted special favors in commercial competition. Caltex will hold 40% interest in the new company, to which it has agreed to assign all of its local marketing, refining, and transportation facilities. Union Generale des Petroles (UGP), a company set up by the French, will hold the remaining 60%.

The joint Caltex-UGP company will continue to use the Caltex trademark, and there will be no interruption of service at sales outlets. These measures were taken to insure customer service and product quality. Caltex outlets are centered in the Bordeaux area, where it has a 25,600-bbl. refinery at Gironde.

Other French interests continue to be gloomy, however, because they believe the powerful government-controlled agency, Bureau de Recherches de Petrole (BRP) through UGP is seeking control of at least 20% of the French market. The agreement with Caltex gives UGP control over only 3.75% of the French market. Private interests fear that UGP cannot hope to reach the 20% level without using discriminatory measures against other companies.

The apprehension has not been helped by the French minister of mines, who favors a tighter rein by government over industry in general, and who was a prime mover in the formation of UGP. He says the entry of French crude producers in domestic marketing will go hand in hand with increasing demand. The government has a stake in most of this production.

The minister contends the disposal of Saharan crude production by means of sales contracts with refiners can be satisfactory only under certain conditions. These are that the contracts must be on very long terms and include price guarantees.

Divided opinion . . . There are two distinct viewpoints in France about the success of the local refinery industry in making room for Sahara crude.

Esso Standard, SAF, said recently that 82% of the orphan crude, which is oil produced by French companies without marketing organizations, is already sold for 3 years under contracts with international companies.

BRP rejects the Esso figure. BRP supplies data of its own showing that while 91% of the orphan crude has a market this year, only 67% has an outlet with French refiners in 1961, and 63% in 1962. This means, says BRP, that one-third of the orphan production still lacks an outlet in 1962-63. The bureau also says that actual contracts for sales made to date have been only partially signed.

One-third interest in UGP is held by SN Repal, half owner of Hassi Messaoud oil field. While there is private capital in SN Repal, control is exercised by BRP with 40% interest. The company was the actual negotiator in the Caltex agreement.

Another third of UGP is held by RAP. This is a government-owned holding company with interests in several operating companies. These include CREPS, which is developing major production in the Edele area of Algeria. The final third is split among other French companies with production in other parts of Africa and in France (OGJ, Apr. 25, p. 125).

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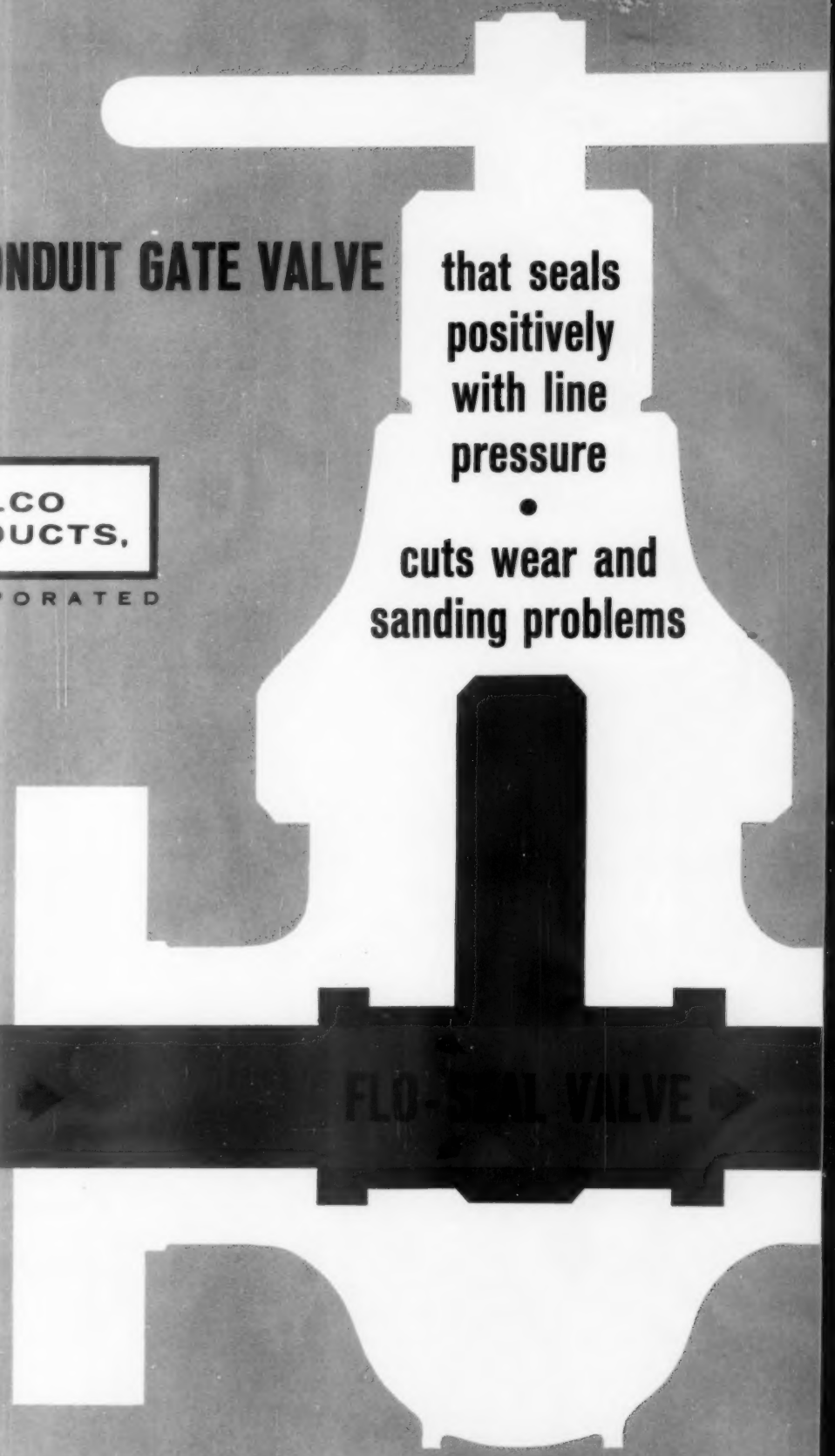

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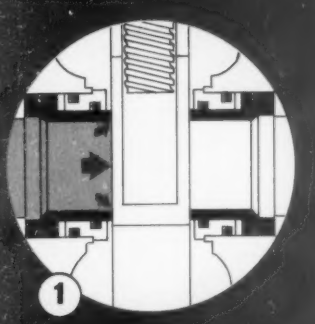

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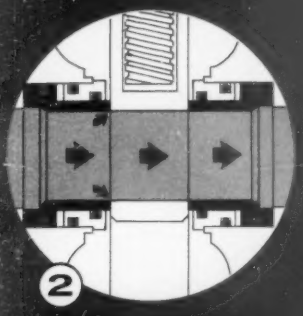

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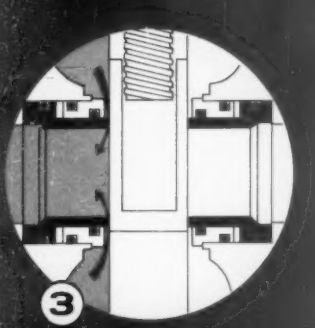

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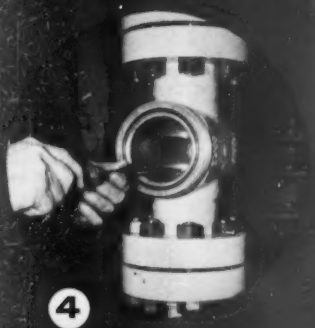

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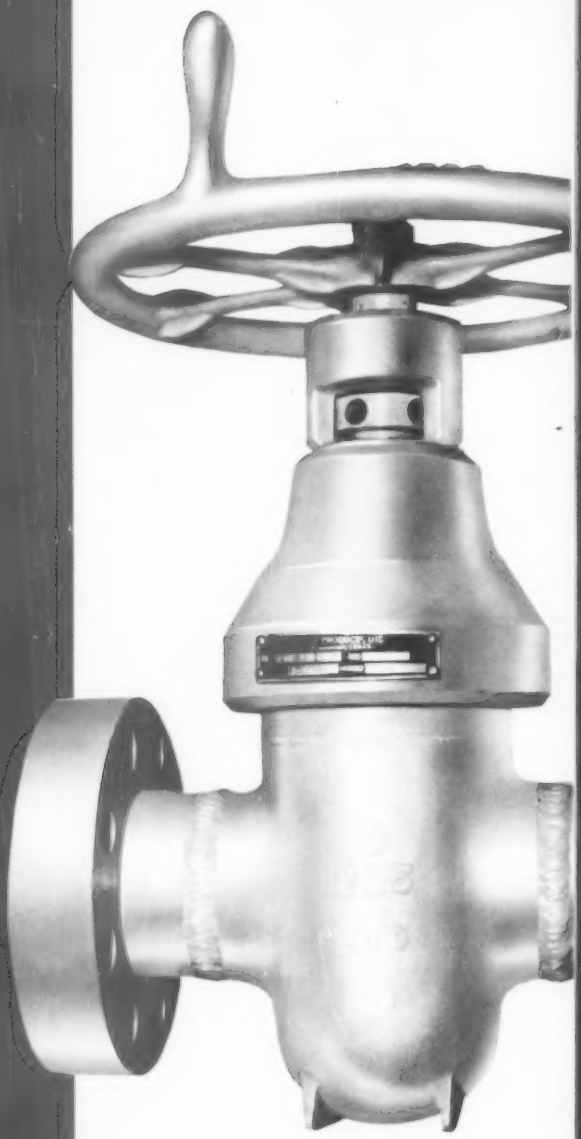
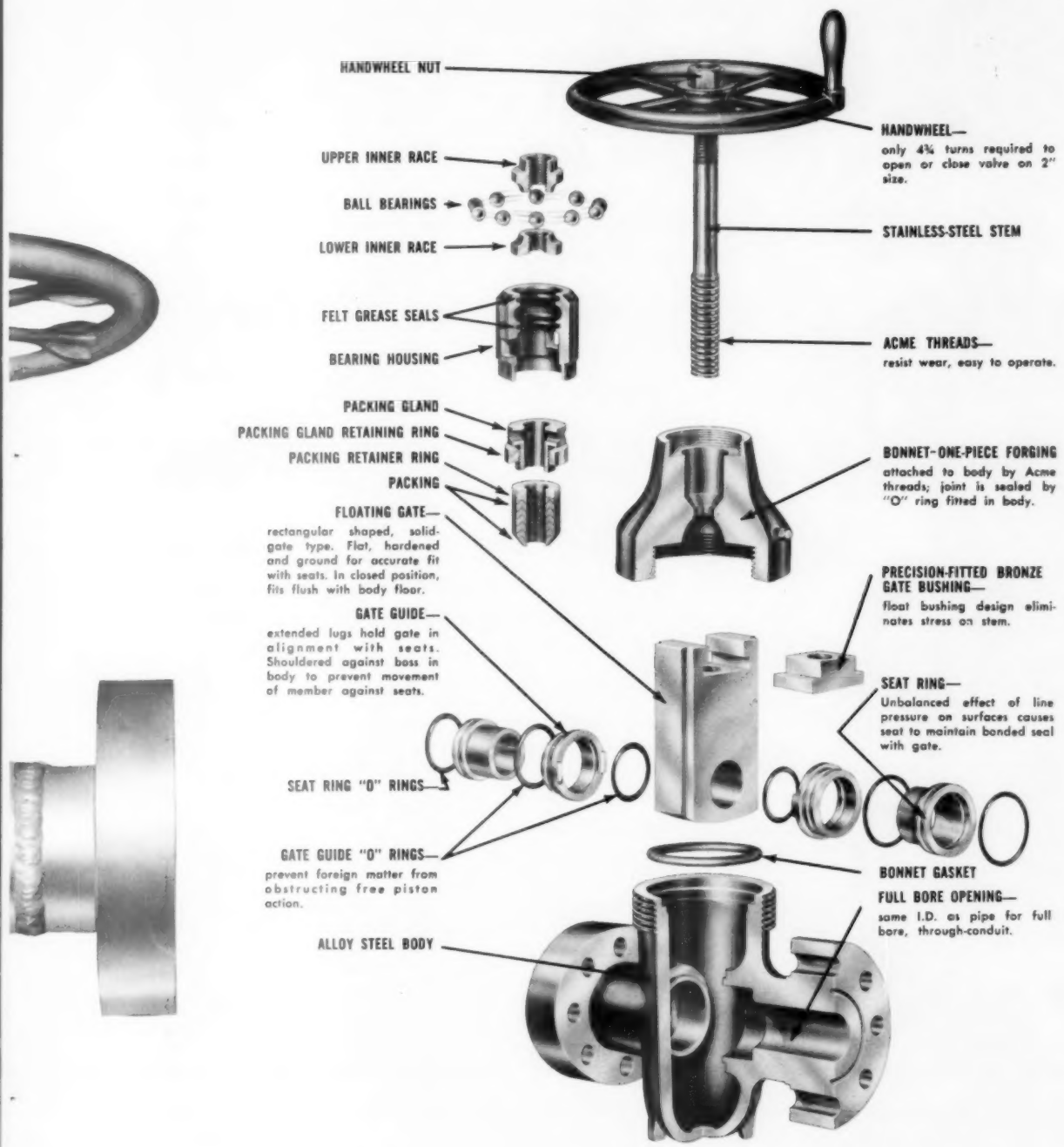


FLO-SEAL VALVE


HANDWHEEL NUT
HANDWHEEL—
only 4¾ turns required to open or close valve on 2" size.
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PACKING
BONNET-ONE-PIECE FORGING
attached to body by Acme threads; joint is sealed by "O" ring fitted in body.
FLOATING GATE—
rectangular shaped, solid-gate type. Flat, hardened and ground for accurate fit with seats. In closed position, fits flush with body floor.
PRECISION-FITTED BRONZE GATE BUSHING—
float bushing design eliminates stress on stem.
GATE GUIDE—
extended lugs hold gate in alignment with seats. Shouldered against boss in body to prevent movement of member against seats.
SEAT RING—
Unbalanced effect of line pressure on surfaces causes seat to maintain bonded seal with gate.
SEAT RING "O" RINGS
GATE GUIDE "O" RINGS—
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same I.D. as pipe for full bore, through-conduit.
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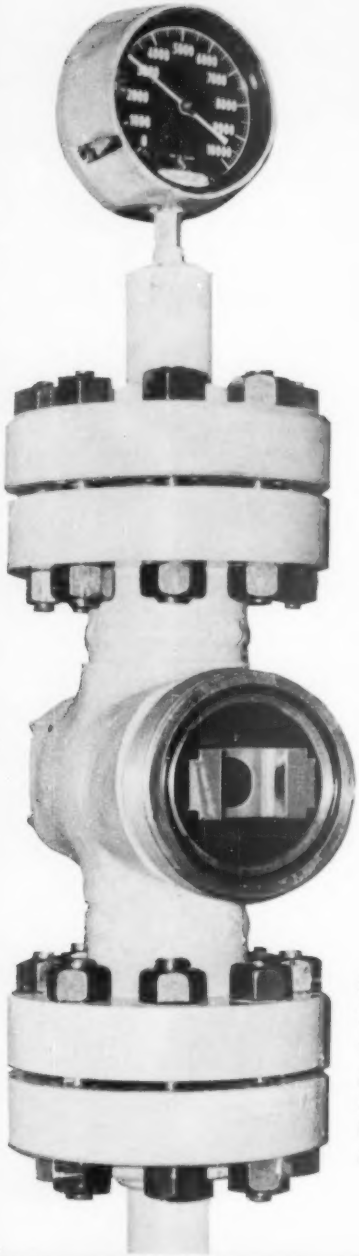
The new ALCO Products, Inc. FLO-SEAL valve uses pressure in the line to maintain a tight metal-to-metal seal between the floating seats and the gate. Result: as long as pressure is maintained, this valve stays tight.

The FLO-SEAL valve has a full-bore, through-conduit design. There are no restrictions to flow. It can be installed with pressure on either side. It has a non-rising stem, with easy-action ball-bearing stem thrust and packing assembly. The valve is available in lubricated or non-lubricated models.



Flo-Seal Valve Proved in field tests

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- ". . . valves do not show any sign of wear . . . continue to hold pressure exceptionally well."
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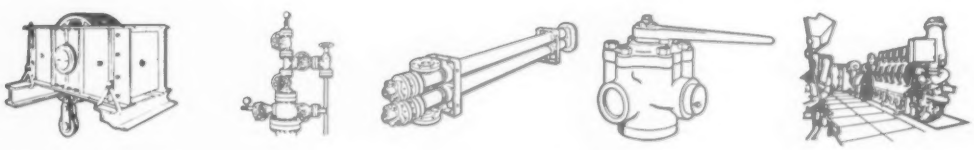
- "For 30 days this valve was subjected to all kinds of abrasive drilling mud, emulsions and lost circulation materials, etc. For a period of 15 days valve was opened and closed as much as 5 times a day, operated at 5,200 lb. . . . very pleased with the operation."

Extensive field tests proved the new FLO-SEAL valve dependable, efficient and easy to operate. As a result of these successful tests, ALCO Products has begun manufacturing the valves in specifications to meet your demands. Available at competitive prices from your supplier.

Recommended for Christmas-tree and flow-line service.

Seals effectively with the bonnet off

This photograph dramatically demonstrates how line pressure effects a positive seal in the FLO-SEAL *gate valve. With a line pressure of 3,000 lb., the bonnet was removed from the valve body. An inspection of the valve revealed that no fluid leaked into the body on either the upstream or downstream side and that the pressure remained constant at 3,000 lb.*



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This is a review of all past and current developments in the drilling of oil and gas wells. Some were marked for failure immediately, some belong in the so-so class, while others show some promise. But they are all here, and a study of this experience could lead to a major breakthrough in drilling methods and technology.

WHEN WILL THE NEXT REAL BREAKTHROUGH COME?

Rotary drilling is improving and will be around for a long time. But . . .

Needed now: A better understanding of the basics of earth boring

BY L. W. LEDGERWOOD, JR.
Jersey Production Research Co.,
Tulsa

CURRENT economic trends in the oil industry point out the need for effective programs to reduce drilling costs.

One approach investigated by the industry is in the development of drilling methods other than rotary. Major effort, however, has been centered on engineering work aimed at incremental improvements in rotary drilling. Relatively minor effort has been expended toward understanding the basic earth-boring process. And this understanding could serve as a foundation for the development of cost-cutting drilling hardware.

Purpose of this article is to review past and present industry efforts to develop new drilling tools or systems and to suggest areas where additional technology is needed.

Complete coverage difficult. Researchers are reluctant to publish papers on unsuccessful, marginal, or suspended developments. This, coupled with the errors in, and obsolescence of printed matter used as source material makes the collection of data on new drilling developments difficult. However, if future programs are to be planned on the basis of yesterday's experience, an effort must be made to collect these data.

Manuscript was prepared for oral presentation at the first API Drilling Research Symposium at Biloxi, Miss., January 13-14, 1960. Published in the April 1960 issue of Journal of Petroleum Technology, publication of the Society of Petroleum Engineers, AIME.

What is future potential of rotary drilling? While it is not the primary purpose of this article to discuss rotary-drilling improvements, some mention must be made of these developments.

TABLE 1—MANY DRILLING CONCEPTS ARE OLD

Flame drill	1853
Bottom-hole rotary hydraulic motor	1873
Electric arc (British patent)	1874
Conventional rotary	1884
Chemicals to soften rock	1887
Bottom-hole electric percussor	1890
Bottom-hole electric motor	1891
Bottom-hole hydraulic percussor	1900
Retractable bit and bottom-hole motor	1902
Reelable drill pipe	1935
Abrasive-laden jets	1941
Shaped explosive charge	1954
Pellet impact drill	1955

Sizable cost reductions have been made in rotary drilling through application of improved technology. This trend will continue. Air drilling holds considerable promise in this direction.

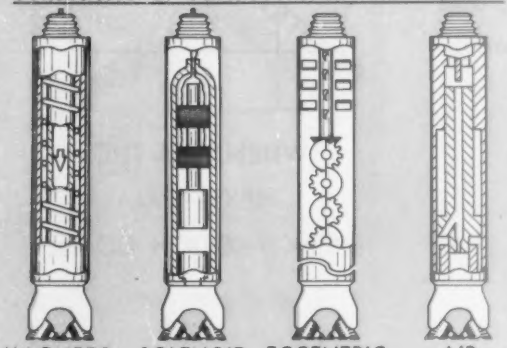
Application of the best current technology to the operation of all rigs will continue the cost-reduction trend. But this will require education and motivation. For example, it has been found that placing engineers on a rig around the clock for the drilling of several wells in an area has reduced drilling costs 5 to 15%.

Furthermore, as industry gains fundamental knowledge about the rotary-drilling process, it is reasonable to assume that such knowledge will produce even better technology and equipment than we now have. In addition, some items developed for new drilling systems will also be applicable to rotary and further enhance its potential. Thus, industry should not neglect further improvement in rotary drilling.

New drilling methods. Considerably more engineering and development work has been done on new systems than is generally realized. An understanding of the scope, nature, and status of this work will give new insight into the urgency for accelerating

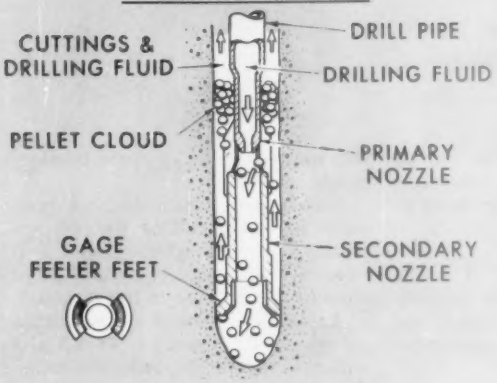
Perpendicularly applied force

SCHEMATIC OF PERCUSSION DRILL DESIGNS



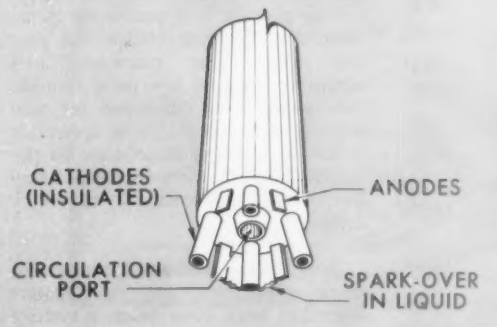
These are some of the ideas that have been tried in developing percussion drills. Operational details are given in Table 3, along with current status. The only present commercial percussion drill is similar in operation to air hammer shown here. Fig. 1.

PELLET IMPACT DRILL



The pellet impact drill uses force of impingement of steel balls on formation to make hole. Fluid rate is about 520 g.p.m., developing 174 h.hp. About 170 lb. of 1¼-in. steel balls is used. They attain a velocity of about 75 ft. per second. Efficiency of drill is about 4%. Fig. 2.

RUSSIAN SHOCK WAVE DRILL



Russian shock-wave drill uses effect of electric arc jumping a spark gap to break up rock. Complex electric distributor causes the four anodes to be connected into circuit in rotation. Russians estimate that field tool to drill a 10-in. hole at 10 m. per hour would require an input of 200 kw. Fig. 3.

basic studies of the drilling process.

Industry has tested most of the known new drilling concepts. In reality, these new concepts are quite old and have been public knowledge for many years. Table 1 shows the initial dates of patents pertaining to some of the better known new drilling systems. All of these have been evaluated by field or laboratory experiments.

In evaluating the ideas in Table 1, industry has probably spent more than $25,000,000 in development and test work. Maximum rates of expenditure on a single tool or system have ranged from $200,000 to over a million dollars per year. This work has been conducted by both oil industry and commercial research organizations. In at least one case, a sizable research and development organization was created and staffed solely to develop a particular drilling tool.

To date, this work has not resulted in a drilling tool or system that can appreciably cut general drilling costs. In some cases, of course, the tools developed are more economic under specific, limited, operating conditions than is rotary drilling. For example, where air drilling can be used, the air percussor appears to be gaining acceptance. However, in spite of industry's efforts to replace rotary with a superior method, rotary drilling retains its leadership as the most versatile and generally economic earth-boring method. This is eloquent testimony of its merit.

For convenience of discussion, industry's efforts to develop new tools and systems are divided into two general categories: (1) work concerned with rock-attack means, and (2) work concerned with novelty other than method of rock attack.

Attack forces normal to rock

Developments seeking to implement means for applying forces normal to the rock have been the most extensive of all of industry's developments. Table 2 lists these efforts.

Percussors and vibrators: The basic premise underlying percussor and vibrator developments is that drilling rate can be increased by adding vibratory power to the already available rotary power. Fig. 1 shows schematically some of the more important means investigators have used to add vibratory forces to those derived from normal bit rotation. All four of these tools, including several variations of some of them, have been field tested. Expenditures on this work probably approach 10 million dollars.

The magnetostriction tool utilizes a long bar of magnetrostrictive mate-

rial, such as nickel inside a coil of wire at the bottom of the hole. A bit is attached to the lower end of the bar. A conductor down the middle of the drill pipe transmits electricity to the coil in the bottom-hole tool. The pulsing magnetic field from a combination of direct and alternating current in the coil causes the magnetostrictive material to change its length at the same frequency as that of the magnetic field. The magnetic field frequency is adjusted to the resonant frequency of the bar, and the resultant vibration is transmitted directly to the bit to assist in rock failure.

The solenoid hammer-type percussion tool also has an electrical conductor down the center of the drill string. This conductor transmits a continually reversing current to solenoid coils within the bottom-hole assembly; this current raises and lowers the solenoid armature inside the coils. The solenoid armature terminates at its lower end in a hammer. The changing field in the solenoid coils causes the armature-hammer combination to repeatedly strike an anvil, which is attached to a rock bit.

The eccentric-weight percussion tool uses a series of unbalanced rotating members to set up unbalanced vertical forces without any lateral unbalance. Mud is pumped down the drill string and through the axial-flow mud turbine in the bottom-hole apparatus. The output shaft of the mud turbine drives a chain of spur gears to which are attached eccentric weights. The weights are positioned so that the successive quarter-revolutions of the weights there is initially no lateral unbalance, followed by vertical unbalance (up), no lateral unbalance, and finally vertical unbalance (down). Then the cycle repeats. The lower end of the case containing the eccentric weights is attached to a long section of drill collars and the eccentric weights are revolved at the axial resonant frequency of the drill collars. By operating at the resonant frequency, large displacements are obtained at the ends of the drill collar section. The motion of the end of the collar, is transmitted directly to the bit and the vibratory energy is used to break the rock. The basic operation of the drill follows accoustic principles, hence this vibratory tool is called the sonic drill.

The air-hammer drill is one of many configurations used which involve fluid flow, valves, and a reciprocating piston to achieve the desired vibratory forces. The particular configuration shown uses air pressure to raise the central piston (hammer) until its lower end clears the circular anvil and releases entrapped air. Simultaneously, the valve finger in the upper part of the drill body enters a central passage in the top end of the piston, causing an air-pressure buildup which reverses the direction of piston travel. These valving effects result in a stable vibration of the piston on the annular anvil, which is directly attached to the bit.

TABLE 2 — INVESTIGATORS EMPHASIZING FORCES NORMAL TO ROCK

Percussors and Vibrators	
R. Bassinger	Hammer drills
Hughes Tool Co.	
Gulf	
Pan American	
Mission Mfg. Co.	
Ingersoll Rand	
Gardner Denver	
Russians	
Bodine	Other
Borg-Warner	
Drilling Research, Inc.	
American Percussion Tool Co.	

Table 3 summarizes some of the more salient points regarding typical percussion-drill operating characteristics. Investigators have used a wide range of actuation means to attain vibration. Also, this experimental work has covered frequency ranges from 6 to 300 c.p.s., hammer weights of 10 to 300 lb., and vibratory amplitudes (hammer or bit, as applicable) of ¼ to 3½ in. Power output of the vibratory mechanisms of these tools has ranged from 10 to 20 hp. in the case of the American Percussion Tool Co. unit to more than 80 in the DRI and Borg-Warner developments.

The current status of major percussion developments is shown in Table 3. The only commercial percussion tool now available is one initiated by Bassinger, refined by Pan American, and offered commercially by Mission. This tool is air-actuated and, unfortunately, this actuation severely restricts its general utility since industry's inability to cope with water influx in air drilling limits the use of air to 3% or less of hard-rock footage. Mission also has under development a liquid-actuated percussion tool. The Gulf Oil Co. percussor is a liquid-actuated tool and Gulf reports that its licensee (Continental Emsco) is making final tests on this tool before offering it commercially.

The other percussor developments became inactive for various reasons. The Hughes Tool Co. percussor became inactive when field-test work showed the tool to have only very limited application for economic operation, this application being in areas where rotary drilling tended to produce crooked holes. The Borg-Warner development of Bodine's sonic drill was discontinued when additional expenditure to prevent the mechanical failure of certain downhole components could not be justified. To date, American Percussion Tool Co. has been unable to secure the financial backing necessary to continue development of its percussor. The DRI development became inactive because of lack of funds to overcome transmission-line problems and the inability of the downhole vibrator to develop enough power output into the load represented by the rock.

Pellet impact drill. Purpose of this tool is to provide a rock-attack means that can be replaced without the tool being pulled from the hole. Application of this concept involves the use of high-velocity pellets impinging on the rock to cause failure. As the pellets wear, new pellets are added to the system, while the drill pipe remains in the borehole.

Fig. 2 shows schematically the configuration used to implement the pellet drilling concept. A primary nozzle is attached to the lower end of the drill string, and a larger secondary nozzle is suspended below the primary nozzle by means of an open bridging structure. Drilling fluid pumped down the drill pipe issues from the primary nozzle with a very high velocity and the high-velocity jet acts as an aspirator to pull fluid and steel pellets into the secondary nozzle. The pellets are accelerated in the secondary nozzle and ejected against the formation at a high velocity, causing local crushing at the point of impact. Rising fluid lifts pellets and the powdered rock cuttings to the top of the secondary nozzle. At this point, about four-fifths of the rising fluid is drawn back into the secondary nozzle by the tool's aspirator action.

Since most of the fluid is recycled through the secondary nozzle, the annulus velocity alongside the primary nozzle is quite low and the pellets remain suspended at this point in the rising fluid. The cuttings are carried up the annulus to the surface. Pellets from the suspended cloud enter the secondary nozzle in a random manner.

In the development of the pellet impact drill, extensive laboratory testing and in-the-ground drilling was done with 4¾-in. diameter tools to optimize design parameters and operating con-

TABLE 3—TYPICAL PERCUSSION-DRILL OPERATING CHARACTERISTICS

Investigator	Types	Freq. C.P.S.	Wt. Lb.	Stroke In.	Present Status
Mission (Pan American)	Air	30	80	1.0	Commercial
Ingersoll Rand	Air	15-25	50	3/8	Under development
Gulf	Mud	6- 7	300	3-3 1/2	Being modified
Hughes	Mud	30-35	112	1 3/8	Inactive (1955)
Borg-Warner (Bodine)	Mud turbine Eccentric wt.	100	NA	1/4	Discontinued (1958)
A.P.T. CO.	Solenoid	30	10	5/8	Inactive (1955)
DRI	Magneto-striction	300	NA	1/16	Inactive (1957)

ditions. A pellet drill for a 9-in. hole was designed, built, and lab tested.

Calculations based on primary nozzle pressure drop and flow rate, and on the number, weight, and velocity of pellets striking the rock showed that the input at the primary nozzle was 175 hydraulic horsepower, and the output was only 6.5 hp. This makes the bottom-hole apparatus only 4% efficient.

The pellet impact drill development is inactive. In its present form this drilling method can physically penetrate rock materials, but it cannot do so economically in comparison with rotary drilling. Two factors contribute largely to the poor competitive position of the pellet drill: (1) the acceleration of pellets by fluid in the secondary nozzle is basically an inefficient process, and (2) the drilling method requires that all of the rock be reduced to a powder prior to removal from the hole, and this process requires more energy than if the rock were removed in the form of larger chips.

Shock-wave drill. The basic concept of this Russian-made tool involves shock waves traveling through liquid to deliver crushing loads to the rock.

Fig. 3 illustrates schematically the laboratory drill used by the Russians to generate shock waves. Four insulated cathodes are spaced around the lower periphery of the tool with anodes interspersed between. Drilling fluid is circulated down the center of the tool out of a circulation port, and thence up the hole annulus to remove rock debris.

In operation, the cathodes are energized in sequence around the periphery of the tool. As each cathode is energized, a spark travels from the cathode to the two adjacent anodes. The occurrence of the spark initiates a shock wave which propagates through the liquid and crushes the rock.

Complex electrical circuitry, operating through a mechanical rectifier, is used to supply current to the drill. Using a laboratory setup, the Russians report that they have been able to penetrate 10-in. slabs of dolomite and concrete. No operating cost data are available.

Table 4 summarizes some of the more important characteristics of the shock-wave drill. On the basis of their laboratory work, the Russian investigators estimate that a field tool to drill a 10-in. diameter hole 10 m. per hour would require about 200-kw. input. With rotary tools comparable performance could be obtained with only about one-tenth to one-fifteenth as much power input to the bit. It must be recognized, however, that the shock-wave drill has no mechanical contact with the rock and conceivably might be a very long-life tool.

TABLE 4—RUSSIAN SHOCK WAVE DRILL
Reported Characteristics

Input energy/discharge, Kg.M.	100
Volume crushed/discharge, CM^3	0.7
Discharges/minute	330
Discharge duration, seconds	10^{-6}
Instantaneous power, kw.	0.5×10^7
Output energy/discharge, kg.M.	32
Efficiency (electrical), %	32
Max. condenser, voltage, volts	50,000
Total capacitance, μ F	0.26

The Russian investigators have recommended that this method be tested in the field and, hence, it is presumed that the development is active to some degree.

Explosives drill. The explosive method most frequently employed uses a shaped charge to disintegrate the rock.

Fig. 4 illustrates the principle of operation of the McCullough explosives drill, and gives some of its reported characteristics. This tool is lowered into the borehole on a conducting wire line and the shaped charge is detonated when the tool reaches bottom. The tool must then be withdrawn from the hole, reloaded, and mechanical means employed to ream the hole prior to the use of another shaped charge.

This tool has reportedly been used in the field to penetrate very hard surface strata. While no economics are given, it is estimated that explosive costs alone would amount to about $18 per shot, to which must be added other operating costs to compute the total cost per foot of hole.

It is understood that this tool is currently available from a service company for special applications such as disintegrating stuck rock bits and reamers or drilling very hard surface formations. However, no further development work has been reported.

The exact principle of operation of the Russian explosives drill is unknown. Russian technical literature deals only with the mechanism of rock failure under explosive attack, and with the results of field trials; it does not describe the explosives used or any pertinent bottom-hole apparatus. It is apparent that some sort of a bottom-hole apparatus which requires changing is used with the explosives drill, because the Russians report that a trip is necessary after 20 m. of drilling with the explosives drill. No economics are given for explosives cost or for cost per foot of hole.

Fig. 5 illustrates the basic concept of the Russian explosives drill and lists some of the results obtained. It is known that some sort of explosive packages are pumped down the drill string one after another and caused to explode at the hole bottom. It is not known whether mechanical reamers, shaped charges, inertia detonators, or downhole magazines are used.

Field drilling in cherty limestone gave explosive drilling rates four times those attained with standard Russian turbodrill practice. Footage per trip into the hole with the explosive apparatus was six times that obtained with a bit on a standard turbodrill.

Judging by the treatment given this development in the Russian technical literature, their development of the explosives drill is still on an active basis.

Calyx drill. This tool is another that provides for renewable cutting edges without the drill string being pulled. The concept is implemented much in the same way as that of the pellet drill, except instead of using pellets under high-velocity impact to cause rock failure, very small pellets are loaded statically and rolled around the periphery of the borehole to cause local failures where the pellets contact the rock.

The principle of operation of the calyx drill is shown in Fig. 6 along with its operating characteristics. Small, chilled steel shot (on the order of $\frac{1}{16}$-in. diameter or less) is pumped down the drill string with the drilling fluid. The drill string is attached to a long tubular core head which, at its bottom end, is simply a blunt steel shoe. The small steel shot becomes trapped under the lower end of this blunt shoe and as the shoe rotates on the shot, the shot cuts an annulus by grinding the rock into a very fine powder; broken shot and flourlike cuttings are collected on the top side of the bottom-hole assembly. After the core head has cut its maximum depth, it is withdrawn from the hole and a corebreaker is lowered into the hole to break off and withdraw the core.

The calyx drill has been in commercial use for a number of years in the mining and construction industries, where it is used primarily for sinking large-diameter shafts in rocks.

Developments Emphasizing Bit Rotation

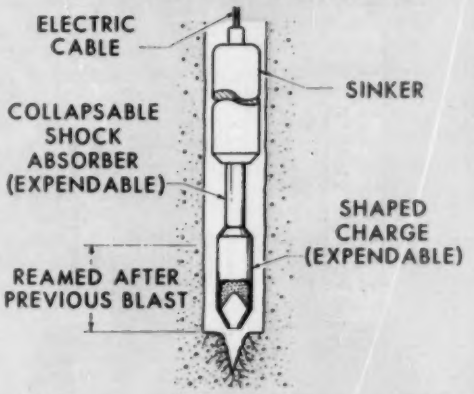
Another approach to mechanical rock attack uses force normal to the rock, with emphasis on bit rotation means. Table 5 lists developments concerned primarily with bit rotation means and their principal investigators. This work has very broad scope and represents an expenditure of at least several million dollars.

Turbodrills. The basic concept of the turbodrill is to transmit relatively large amounts of power to the bit through the drilling fluid, thereby overcoming the limitations of transmitting power by means of a long, rotating drill string. With currently available turbodrills the increased power is presented to the bit in the form of much higher r.p.m. than can be safely used with conventional rotary practice.

Perpendicularly applied force

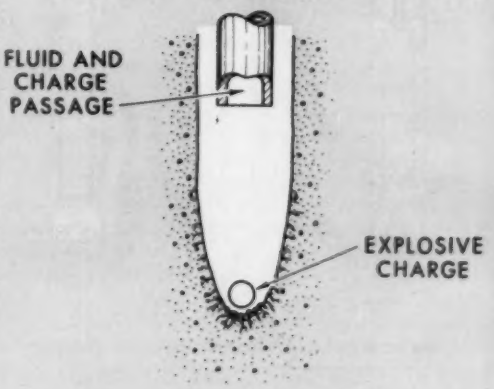
McCULLOUGH EXPLOSIVES DRILL

McCullough explosive drill uses shaped explosive charges 4 in. in diameter, 8 in. long, and weighing 5 lb. The detonation produces a tapered hole up to 4 in. in diameter, with a penetration up to 3 ft. Best results have been obtained in hard rock. Fig. 4.



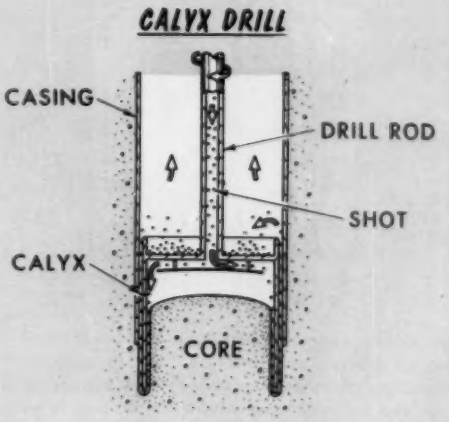
RUSSIAN EXPLOSIVES DRILL

Russian explosive drill apparently uses explosive pellets that can be placed at the bottom of the hole without pulling the drill pipe. While few data are available, "bit" life is reported to be about 20 m. Tool has been used at 3,000 m., with penetration of 0.6 m. per hour. Fig. 5.



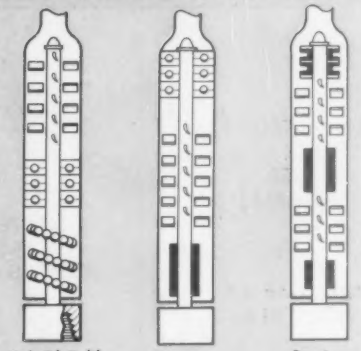
CALYX DRILL

Calyx drill uses small steel shot to provide a renewable cutting edge. Shot is pumped down well with drilling fluid and is circulated at bottom of hole until consumed. Tool is pulled only when core reaches 5 to 6 ft. in length. Hole diameters from 5 to 72 in. can be drilled. In a 48-in. hole, average rate is 7 to 18 in. per hour with shot consumption of 2 to 3 lb. per foot. Fig. 6.

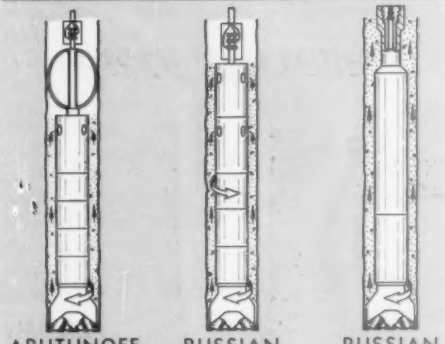


Forces emphasizing rotation

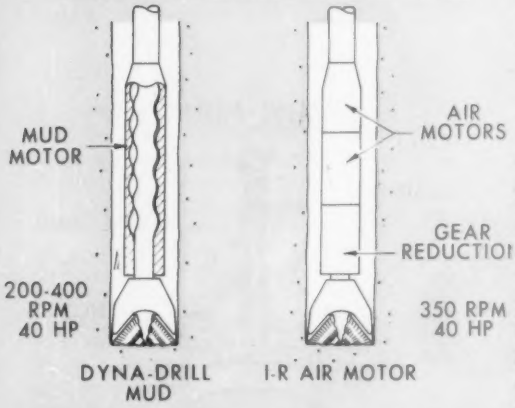
SCHEMATIC DESIGNS OF TURBODRILL



SCHEMATIC OF ELECTRODRILL DESIGNS



SCHEMATIC OF FLUID MOTOR DRILLS



These three tool types have one thing in common: there is no drill-pipe rotation. Power is supplied to bit through a unit at bottom of drill pipe. In the turbodrill, Fig. 7, power for rotation is developed in mud turbine just above bit. Shown here are three of several turbodrill designs that have been in use. Only commercial application of the turbodrill at this time is in Europe. In Fig. 8 are shown three models of the electrodrill. This drill uses an electric motor above the bit to supply rotative power. In the Russian pipe drill on the right, drilling fluid is pumped down drill pipe and back up annulus in a conventional manner. In the other two, a small circulating pump operates at the bottom of the hole, and cuttings are caught in a bailer at top of tool. Reactive torque in the Arutunoff tool is absorbed by the friction dogs, while the Russian pipeless tool uses fluid drag against the upper counter-rotating parts. Fluid motor drills, Fig. 9, supply power to bit at speeds slightly higher than that in ordinary rotary drilling, but lack the complexity of turbodrills. Power for the Dyna-drill is obtained from a helical rotor operating on drilling-mud pressure. The Ingersoll-Rand drill uses two air motors operating through a gear-reduction system to supply rotation. This latter tool can only be used where air drilling is possible.

An axial-flow mud turbine is placed at the bottom of the drill string and the bit is attached to the turbine output shaft. The early Russian designs used a high-speed turbine with gear reduction between the turbine shaft and the bit. A more recent design does not use gear reduction. The major difference in the design of recent turbodrills has been in blading and bearings. The Standard Oil Co. of California turbodrill used machine ball bearings for the thrust bearing and rubber radial bearings at each turbine stage, plus radial ball bearings near the bottom of the tool. The Parsons tool used ball thrust bearings and a rubber lower-radial bearing. Other turbine designs have made wide use of rubber in both the thrust and radial bearings.

All three of the turbodrills shown in Fig. 7 have been extensively field tested. The Russians have been continually working with turbodrill developments since the late 1920's or early 1930's. Dresser Industries has been the most active recent investigator of turbodrills in the United States.

Performance characteristics of the turbodrill depends on the flow rate and can be varied over a considerable range by varying the flow rate. Reported operating characteristics and present status are summarized in Table 6. It is interesting to note that the output horsepower deliverable to the bit ranges from 14 to 418 hp., and that bit speed ranges from 400 to 750 r.p.m. By way of comparison, average current rotary practice will utilize about 20 hp. at the bit at bit rotary speeds between 40 and 250 r.p.m.

Not shown in Fig. 7 is an 8-in. o.d. air-operated turbodrill that has been developed by Ingersoll-Rand. A gear drive is employed beneath the air turbine to reduce output shaft speed from 3,500 to 300 r.p.m.

In one field test of this tool, injection rate averaged 1,300 cu. ft. per minute of air at 174 psi., compared with 900 cu. ft. per minute at 174 psi., with conventional rotary equipment. Fifteen thousand to twenty thousand pounds bit weight gave the best results. Penetration rate averaged 81 ft. per hour, compared with an average rate of 40-45 ft. per hour for conventional air drilling. Mechanical troubles, apparently in the gear-reduction system, terminated the initial field test.

Testing of the I-R air turbine was suspended in late 1957. Since that time, an improved version has been built, but not field tested. Further work has been discouraged by the high cost of the turbine and by bit-life problems.

TABLE 5—INVESTIGATORS EMPHASIZING BIT ROTATION MEANS

Turbine Drills	
Russians	Dresser
Standard of California	French (Neypric)
C. Parsons (EDCO)	U. S. Industries
Ingersoll Rand	
Electric Motor Drills	
A. Aruntunoff	Russians
Fluid Motors	
Ingersoll Rand	Smith Tool Co.

Extensive field testing in the United States has shown that U. S. rotary tools and best U. S. rotary practices give lower cost per foot of hole than the turbodrill except in very special cases such as large-diameter, hard-rock, surface holes or in certain directional drilling problems. The turbodrill is commercial in Europe for two reasons: first, European contractors have not had drill pipe and collars of sufficient quality to permit them to use best rotary practices without excessive pipe failures; second, in Europe, the premium is on maximum hole per year, not minimum dollars per foot.

In the United States, further turbodrill test and development work has been suspended and the effort in this area is being directed toward the development of a suitable bit for use with the turbodrill. Recent work indicates that the turbodrill bit problem is related more to cutting structure configuration and basic rock failure principles than to bearing failures.

Electrodrill. The basic concept of the electrodrill is to supply mechanical power to the bit without rotation of the drill pipe and, in some cases, to completely eliminate the drill pipe. Some work has also been done to increase the power available at the bit as compared to rotary drilling.

Fig. 8 illustrates the principle of operation used in each of the three major electrodrill developments. The Arutunoff tool is lowered into the hole on a conducting wire line that transmits electrical power from the surface to a slip-ring assembly at the upper end of the tool, which prevents torque from binding the cable. An electric motor inside the bottom-hole apparatus drives the bit through a gear-reduction system and also drives a small fluid pump which gives a local bottom-hole circulation, as shown by the arrows. Friction dogs grip the hole wall and transmit reactive torque from the tool to the formation.

The top section of the tool is a bailer. The pump circulates fluid and cuttings into the bailer, where the cuttings settle out. The fluid is then discharged from ports in the bottom of the tool to pick up cuttings and carry them up to the bailer. When the bailer is full, the tool must be pulled from the hole, the bailer emptied, and the tool run back to bottom again.

The Russian pipeless electrodrill has several bailer sections similar to that of the Arutunoff tool and also has an internal pump for local bottom-hole fluid circulation, but it is different in other respects. A slip-ring section on the upper end of the tool permits the upper body of the tool to rotate in a direction opposite to that of the bit. The drag of the fluid on the upper body furnishes the torque reaction required to rotate the bit against the formation.

The Russian electrodrill on pipe has an electrical conductor cable that passes through the center of the drill pipe with connectors at every drill-pipe joint. Drilling fluid is circulated from the surface down the drill pipe and back up the annulus to the surface. An electric motor in the bottom-hole apparatus rotates the bit, and the drill pipe takes the reactive torque.

All three of the electrodrills have been field tested.

Table 7 summarizes the typical operating characteristics and status of electrodrills. Again, it is of interest to note that for the most part the power and r.p.m. ranges of the Russian tools are considerably beyond those normally associated with rotary practice.

The Arutunoff electrodrill development became inactive in the United States in 1953 because of organizational difficulties and lack of adequate financial backing. The Russian electrodrill work is active, and according to reports, about 100,000 ft. of hole per year is being drilled in Russia in the development of this type tool.

Fluid motors. The concept of these motors is to supply bottom-hole rotary power at somewhat increased r.p.m. as compared to rotary, but without the complexity and cost of downhole turbines.

The principle of operation of two such fluid motors is shown in Fig. 9. The Smith Tool Co. Dyna-Drill is a downhole motor operated by pumping mud along a helical rotor inside a specially designed stator (a Moyno pump uses this principle in reverse). The Dyna-Drill is designed to rotate the bit at speeds ranging from 200 to 400 r.p.m. and to deliver a maximum of about 40 rotary horsepower to the bit, for 7⅞ through 9-in. bit sizes.

The Ingersoll-Rand drill has two air motors connected by a gear reduction to the rotary bit. This tool is 8 in. in diameter and is designed to give a maximum of about 40 hp. at the bit at about 350 r.p.m. Of course, the Ingersoll-Rand tool is applicable only to drilling that can be done with air as a drilling fluid, which, as previously stated, is a very small percentage of the total footage drilled.

TABLE 6—REPORTED TURBODRILL CHARACTERISTICS*

	O.D. Range	Flow Rate G.p.m.	Press. Drop Psi.	Output Hp.	Torque Lb.-Ft.	R.p.m.	Present Status
Standard of California	7 9	300- 550	156- 576	14- 93	174- 650	400- 750	Inactive
Parsons	10¼	880	780	300	....	450	Inactive
Neyrpic	10	800	925	236	1,650	750	Commercial in Europe
Dresser	5 10	127- 951	600- 1,152	21- 418	181- 3,002	585- 730	Field operations suspended (1959)
Russian	Essentially same as Dresser Tools						Commercial in Russia
U.S.I.	No data reported						Inactive
I-R	Air operated						Inactive

*Characteristics depend on flow rate.

TABLE 7—TYPICAL ELECTRODRILL CHARACTERISTICS

	Arutunoff	Russian (Pipeless)	Russian (Pipe)
O.d.	5⅜ in.	5 in.	6¾ in.—10 in.
Power Supply	3ϕ, 60 c.p.s., 935 volts	.....	3ϕ, 1,100 V
Motor Power	17½ hp.	50 kw.	100—280
Motor R.p.m.	3,600	2,400	530—920
Bit R.p.m.	265 675	2,000	530—920
Hole/Trip	30 ft.—60 ft.	8 ft.—65 ft.	.....
Status	Inactive	Active	Active

Both of these drills have been field tested. The Dyna-Drill is still under development. Because the limited market may not justify development and manufacturing costs, the Ingersoll-Rand air motor may become inactive in the future, and further inquiries to Ingersoll-Rand about this tool are not encouraged.

Thermal Attack

There are two basic types of thermal drills, the flame drill and the electric-arc drills. Flame drill investigators are Linde Air Products Co. and Russian engineers. Arc drills were investigated by Drilling Research, Inc. Of the two types, much more work has been done with the flame drill than with the arc drill.

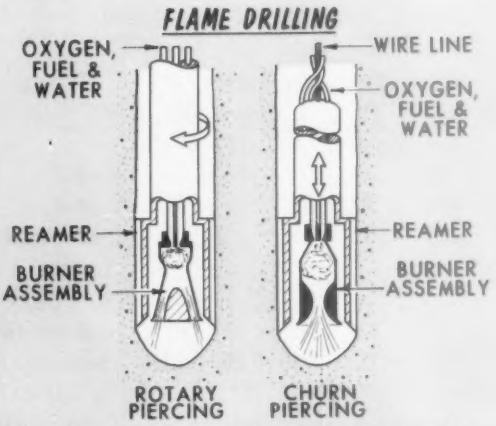
Flame drills. The concept in flame drilling is to use a high-temperature combustion source to spall rock. Fig. 10 shows the principle of operation of two types of downhole flame drills. The rotary piercing method uses drill pipe rotated from the surface in a conventional manner. The churn piercing method employs a bottom-hole apparatus tied to a wire line and is operated in much the same fashion as a cable-tool bit. Fuel and water lines are tied to the wire line.

Both types of flame drills require that oxygen and a fuel, as well as water, be transmitted to the bottom-hole apparatus. The oxygen and fuel are burned in a combustion chamber which is cooled by the water. The high-velocity, high-temperature gases ejected from the combustion chamber spall the rock, and the water helps solidify the slag and also forms steam, which helps remove the debris from the hole. Mechanical reamers are provided to insure that the hole is drilled to gage and to assist in removing spalled rock.

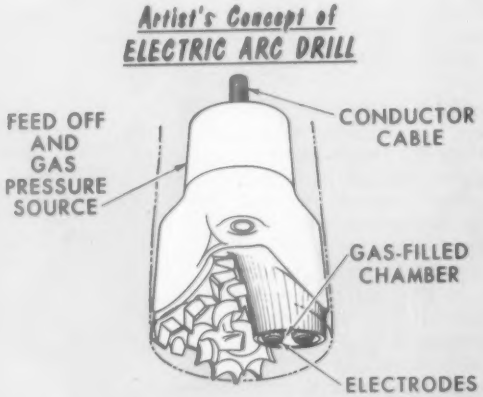
Present flame-drilling systems do not permit the addition of joints of drill pipe to lengthen the drill string. Because of this, rotary piercing is limited to a depth of about 50 ft. and churn piercing is limited to a depth of about 150 ft. Of course, it is necessary to operate these tools in essentially an atmospheric bottom-hole environment.

Flame drilling has been used commercially in the United States for several years for drilling blast holes in granite and taconite mining. It is only under very difficult drilling conditions that the high fuel consumption of this tool can be economically justified. Although some consideration has at various times been given to adapting flame drilling to deep oil wells, so far as is known there is no development work now in progress toward this end. The main deterrents are the adverse effect of high bottom-hole pressures, the fact that not all oil-field rocks will spall, and the complex drill pipe and bottom-hole assembly required to use this method.

Drilling by thermal attack



These flame drills use a high-temperature combustion source to spall rock. Tool at left is rotated to keep hole to gage, and that at right operates as a cabletool. These drills have been tested in holes from 6½ to 13-in. diameter at rates in granite and taconite of 15 to 23 ft. per hour. Typical hourly requirements are 10,000 cu. ft. O_2 at 150 psi., 40 gal. kerosine, and 1,000 gal. H_2O. Flame velocity is about 6,000 ft. per hour at 4,300° F. Fig. 10.



Possible design of an electric-arc drill. Rock spalling is caused by spark jumping between electrodes which are surrounded by an inert gas to prevent shorting. Mechanical cutters keep hole to gage. Drawback of this tool is the electrode consumption rate, 13 in. per minute, and inert gas required to keep well-bore fluids away from electrodes. Tool will use 3,000 volts d.c. at 100 amp. with an arc gap of 1 in. In its drilling operations. Fig. 11.

Electric arc drill. The arc drill uses the same basic concept as the flame drill, but employs an electric arc instead of the combustion process to attain necessary high temperature. Fig. 11 is a sketch of a tool design which might be used for an arc drill, the concept being based on results of experimental work conducted by DRI. The arc drill would involve two electrodes spaced about an inch apart and shrouded by a high-pressure gas-filled chamber to keep the borehole fluid away from the electrodes. Mechanical reaming of the hole gage would have to be provided and is depicted in the drawing by conventional rolling cutters. The down-hole assembly would have to provide a high-pressure-gas source for pressurizing the electrode chamber, and a feedoff mechanism to advance the electrodes as they are consumed. Also, of course, an insulated conductor would be required to transmit power to the electrodes.

The basic principles involved in arc drilling were investigated rather thoroughly through an experimental study by Battelle Memorial Institute for Drilling Research, Inc. Small-scale laboratory tests were used to investigate important variables.

It is interesting to note from Fig. 11 that an electrode consumption of 13 in. per minute is predicted. This is one of the major factors which led to the termination of work with the arc drill. It is probable that electrode technology has advanced since DRI investigated arc drilling in the early 1950's. However, the problems of providing a continuous electrode feedoff of even 1 in. per minute and of providing a tool that could stay on bottom for several hours are appreciable.

Abrasion-Erosion

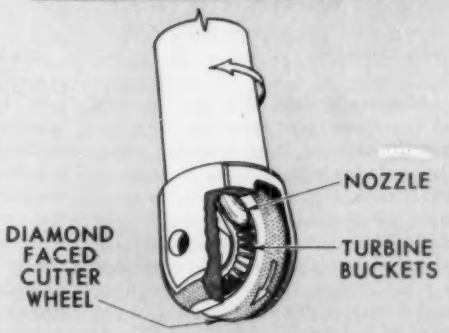
Work has been done on the development of abrasion and erosion methods of drilling. Humble Oil & Refining Co. initiated work on a high-speed, low-torque drill, and this work has been augmented by Christensen Diamond Products Co. Abrasive jet research has been conducted by Dowell and Western Co., and Drilling Research, Inc., has done work on a rocket exhaust drill.

High-speed, low-torque drill. This drill uses a grinding-wheel action to cut hard rock. Fig. 12 illustrates the principle of operation. A nozzle at the lower end of the drill pipe directs a high-velocity jet of mud against turbine buckets that are an integral part of a diamond-faced wheel. This mud jet causes the wheel to rotate at a high speed, and the entire bottom-hole ap-

Drilling by erosion and abrasion

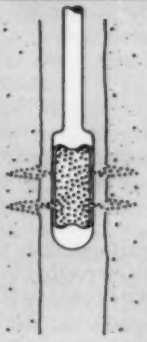
Drilling experiments have been conducted using abrasion and erosion as means to cut through rock. The high-speed, low-torque drill in Fig. 12 uses a diamond-faced cutter wheel to abrade the rock. Wheel is rotated by action of drilling mud on turbine buckets, and entire bit is rotated by drill pipe. Tool has been field tested but is not commercially available.

Humble-Christensen
HIGH SPEED, LOW TORQUE DRILL



The abrasive jet, Fig. 13, is in use for perforating casing and producing formations. It could possibly be adapted to drilling applications, but no known work has been done in that direction.

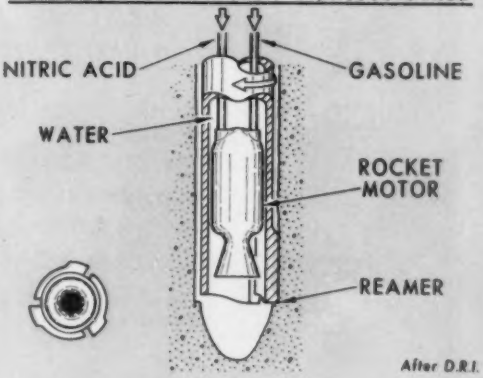
ABRASIVE JET DRILL



ABRASIVE JETS FOR PERFORATING

The rocket exhaust drill, Fig. 14, is similar to flame drill and uses high-velocity, high-temperature gases to erode formation. Analytical work and limited experiments indicate that a 3-in. hole might be drilled in limestone at 30 ft. per hour. Characteristics would include 6,500 ft. per second jet velocity, 3,500° F., and 0.25 lb. per second propellant consumption.

Artist's Concept Of
NEAR-SURFACE ROCKET EXHAUST DRILL



After D.R.I.

paratus is rotated about a vertical axis so as to generate a hemispherical bottom-hole contour. Very low weight is used on the diamond-faced wheel, permitting the diamonds to grind away the formation.

This tool has been extensively field tested, but development is currently inactive and the tool is not commercially available.

Abrasive-jet drill. This drill operates on the abrasive-jet principle. This approach uses a high-velocity liquid stream laden with abrasive particles to erode rock. Fig. 13 illustrates the principle of operation of an abrasive-jet drill. The particular application depicted shows abrasive jets being used for perforating the wall of the hole, rather than drilling the bottom of the hole. In operation, a mixture of liquid and sand or other small abrasive material is pumped down the tubing from the surface and out through small nozzles in the side of the bottom-hole assembly. Nozzles with diameters on the order of ⅛ to ¼ in. are used, with pressure drops about 2,000 to 3,000 psi. This results in jet velocities up to about 650 ft. per second, but normally the duration of these jets is 5 minutes or less. Such an abrasive laden jet is very effective in penetrating steel, concrete, rock, or other materials.

Abrasive jet perforating is a commercial service currently available from at least two oil-field service companies. To date, it has not been applied to bottom-hole drilling, probably because of the problem of supplying and circulating the tremendous quantity of abrasive material that would be required. Nozzle life would be another major problem in abrasive jets used for drilling.

Rocket-exhaust drill. This concept is similar to that of the flame drill and uses high-velocity, high-temperature gases to erode the formation. Development work on the rocket-exhaust drill has been limited largely to analytical work. No complete tool was ever built, and very little direct experimental work was performed.

Fig. 14 is an artist's sketch of a rocket-exhaust drill for use in shallow holes. The sketch is not just a product of the artist's imagination; it is based on analytical work done by Aerojet General for DRI. Fuel and oxidizer are pumped down the drill string to a rocket motor. Water is also pumped down the drill string to cool the reaction chamber, and a mechanical reamer is provided to clean the gage of the hole. The cuttings are returned to the surface by means of the exhaust gases and steam.

The rocket-exhaust-drill development is currently inactive, largely because the economics are not favorable and because of the high back pressure which the rocket exhaust would have to work against in deep, fluid-filled holes.

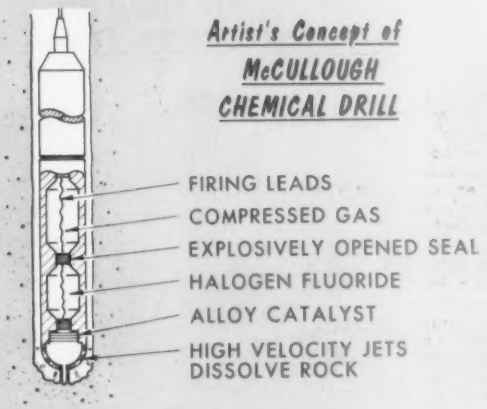
Chemical Drills

Drilling by means of high-speed chemical reactions has been investigated by McCullough Tool Co. The use of rock "softeners" is the subject of research in Russia, and in the United States by California Research Corp. and by the AAODC through Battelle Memorial Institute.

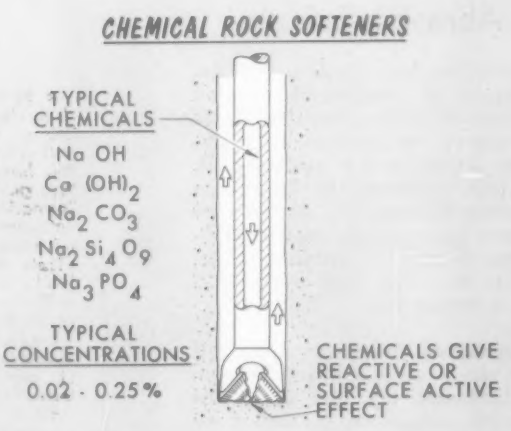
High-speed reactions. The McCullough chemical drill uses a high-velocity chemical stream that reacts with steel or rock to form volatile products which are then blown away from the reaction site. This concept was exploited initially as a means of cutting tubing and casing in deep oil wells. However, it is reported also that the principle has been applied in the laboratory and has successfully drilled sandstone, granite, and other rocks by molecular exchange.

Fig. 15 is an artist's sketch of one configuration that could be used for a chemical drill. A tool containing a chamber of compressed gas isolated from a chamber of halogen fluoride, is lowered into the well bore on a wire line. When drilling action is desired, the seals on the gas chambers are broken by means of electrical detonators and the compressed gas forces the halogen fluoride through a catalyst with a resulting high-velocity chemical jet which reacts with and removes the rock. Of course, the tool would then have to be lifted to the surface, re-

Drilling by chemical means



Chemical drilling became possible with development of chemical tubing and casing cutter. Sketch shows what chemical drill may look like. Sandstone, granite, and other rocks have been drilled in the laboratory by this method. Fig. 15.



Certain chemical substances have shown rock "softening" properties. These softeners could be used in small concentrations in drilling mud to improve the penetration rate of conventional rotary drilling. Fig. 16.

charged, and lowered into the hole again.

A tubing and casing cutter utilizing this chemical drill concept is commercially available to the industry but so far as is known, no further development work has been done on applying this process to rock drilling.

Rock softeners. The basic concept behind the use of rock softeners (hardness reducers) is that chemical adsorption or reaction can change the properties of bottom-hole rock to make drilling easier. The rock-softener chemicals are added to the mud, which is then pumped down the drill pipe, Fig. 16, and the desired chemical reaction or surface-active effect takes place on the rock surface being contacted by the bit teeth.

The basic laboratory experimental work in this field was done by the Russian, Rehbinder, who found that when certain chemicals such as sodium carbonate, sodium hydroxide, calcium hydroxide, and others were added to the drilling fluid in concentrations of 0.02 to 0.25%, some beneficial effects occurred on certain rocks.

Various experimenters in this country have from time to time made laboratory studies of rock softeners with somewhat favorable results. As far as is known, no one has yet been able to translate any of the favorable U. S. laboratory results into practical field application.

At least one major research organization, California Research, is currently active on further development work with chemical rock softeners.

Electric and Magnetic Wave Drills

Exploratory work has employed electrical current and magnetic waves as possible adjuncts to improved drilling methods. Carter Oil Co. investigated the electric-current drill, and the possibility of breaking up rock with magnetic waves has been investigated by Russian engineers and Armco Steel Co.

Electric drill. The application here is based on the hypothesis that an electric current flowing between the bit and the rock will assist the bit in drilling faster. This hypothesis has been evaluated with the laboratory test setup shown in Fig. 17. This test consisted of applying a voltage source across a bit that was drilling rock saturated with brine. The results of the test were inconclusive, and the test was abandoned about 10 years ago. As far as is known, no further work is being done on the electric-drill concept.

Magnetic wave drill. Patents from the mining industry and Russian literature describe experiments with magnetic waves. Fig. 18. The test work described in U. S. patents tells of subjecting a 15-in. cube of taconite to a 5-megacycle signal that had a power level of about 25 kw. The tests were performed by using a single loop of ⅜-in. water-cooled tubing around the block of taconite with about a ½-in. space between the tubing and the block of rock. However, the patent further indicates that it is not necessary to surround the rock with the wave guide, but that a similar destructive effect can be obtained by placing the coil parallel and close to one of the faces of the rock.

When subjected to energy of this sort, experiments have shown that taconite cracks and spalls immediately. The Russians have reported this same effect, using 2½ kw. of power at frequencies of about 3 megacycles. The Russian disclosure also mentions the effect on granite and sandstone, as well as taconite. However, this Russian disclosure was not in a technical publication.

So far as is known, no application of this magnetic-wave principle has been or is being made to oil-well drilling.

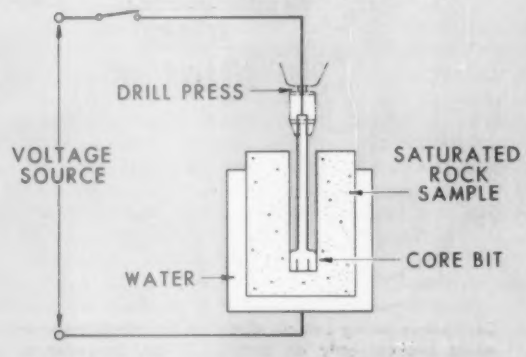
Systems With Novelty Other Than Rock Attack

Industry has been seeking to develop new drilling systems that have novelty other than in method of rock attack. Some of these new developments or ideas are retractable bits, reelable drill pipe, continuous coring, and automatic rigs.

Retractable bits for rotary drilling. Fig. 19 illustrates the principle of operation of the Carter three-cone retractable bit. When in the retracted or collapsed condition, the cones and expanding mechanism can be lowered through oversized drill pipe on a wire line. When the collapsed bit assembly reaches the bottom of the drill pipe,

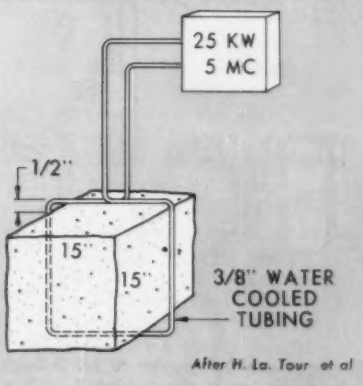
Electric and magnetic-wave drills

ELECTRIC DRILL
LABORATORY TEST SET-UP



Laboratory tests using an electric current flowing through a rock being drilled were inconclusive, and the development has been abandoned. Fig. 17.

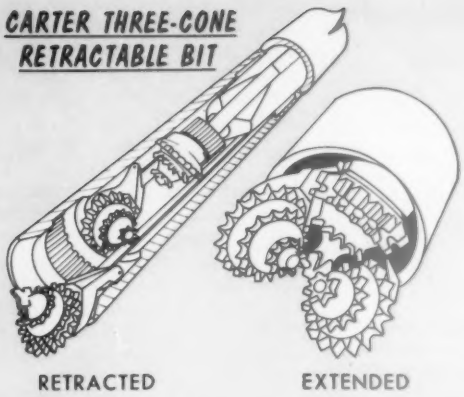
ROCK FAILURE BY MAGNETIC WAVES



After H. La. Tour et al

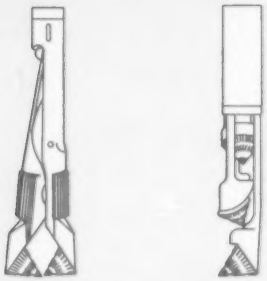
Russian literature and U. S. patent information show that some spalling and cracking will result when a rock is subjected to the magnetic waves. Fig. 18.

CARTER THREE-CONE RETRACTABLE BIT



Use of retractable bits with a rotary drilling rig would reduce rig time by cutting out round trips with drill pipe. Fig. 19 shows the three-cone retractable bit developed by Carter. Three-cone and four-cone models have drilled a total of 1,563 ft. in field tests.

SOVIET TWO-CONE AND THREE-CONE RETRACTABLE BITS



After PETROLEUM WEEK

Big savings, however, would require redesign of surface equipment to reduce investment and permit use of a smaller crew. Russian investigators have reported some development in retractable bits. Fig. 20 shows two models, one with two cones, and one with three.

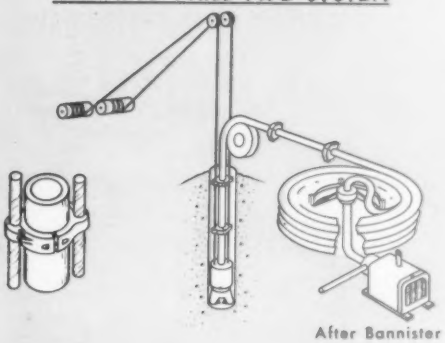
the expanding mechanism expands the cones and locks them in place, as shown in the extended position of Fig. 19. The wire line is then pulled out and drilling started and continued until the cones become dull. At this time, the wire line is dropped down the drill pipe, latched on to the bottom-hole assembly, and the bit is collapsed and pulled out of the drill pipe on the wire line. The cones can then be changed and lowered back into the drill pipe for another run.

The development of retractable bits by Carter included a total of 1,563 ft. of field drilling with four-cone and three-cone models. Based on the drilling rate and bit life results from these tests, calculated economics appeared attractive. However, to realize any appreciable savings, surface equipment would have to be redesigned to reduce investment costs and to permit operation with a smaller crew.

The Carter retractable bit has been licensed to a major bit manufacturer, but no application of this development has been made in the field. Principal reasons for lack of immediate field application are (1) size limitations imposed on cones and bearings by the retractable feature, and (2) surface equipment must be completely redesigned to gain the full economic benefit from this new drilling system.

Retractable bits for turbodrilling. Two versions of retractable bits used by the Russians in turbodrilling are shown in Fig. 20. Russian technical literature reports that their early retractable turbodrill and bit combination was designed to be run on a wire line inside of 8-in. casing and that it was tested in the drilling of two wells in 1954. Trip times of ½ hour from 3,000-ft. depths are reported using this method. This development is still

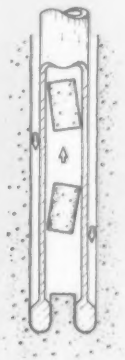
SCHEMATIC OF REELABLE DRILL PIPE SYSTEM



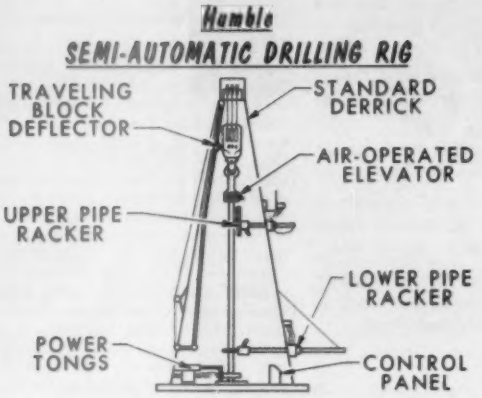
After Bannister

If torque can be applied to bit through some downhole device, as in the turbodrill, drill pipe need not be rotated, and could be flexible. This reelable drill-pipe system could cut down on rig time by speeding up bit changes. Such a system reached 2,000 ft. about 25 years ago. The project was abandoned due to lack of a suitable downhole motor. Fig. 21.

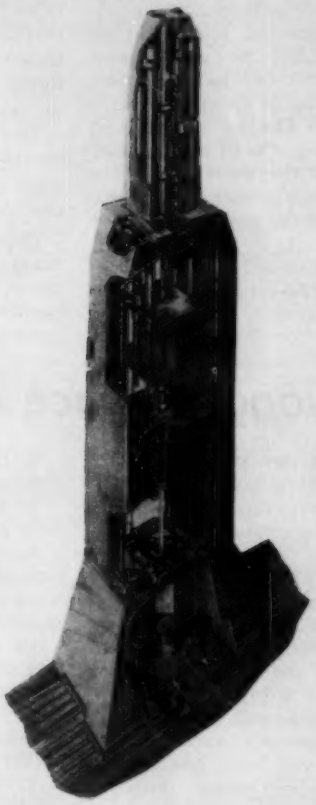
CONTINUOUS CORING WITH REVERSE CIRCULATION



Continuous coring can cut down on rig power requirements because only an annulus is cut. In order to effect any real economies, however, core removal will have to be a fast, simple operation. A Houston firm has reported good results in core removal, and has recently recovered 1,400 ft. of continuous core. Fig. 22.



International Drilling Machines
Mast for Proposed Fully Automatic Drilling Rig



Here are two approaches to automation in drilling of oil and gas wells. Fig. 23 shows essential features of Humble's semiautomatic rig that has been used in actual field tests. At least 1 year was spent in field testing and over 75,000 ft. of hole was drilled. There was no reduction in personnel on this rig, as the semiautomatic nature of rig provided for steel "hands" to do the work, and one man at each station to operate each set of hands. The fully automatic rig in Fig. 24 has applied the concepts of machine-tool automation to oil-well drilling. Work so far has dealt with models, and construction of the prototype is not expected to begin before the fall of 1960.

active and recent reports indicate that increased emphasis is being placed on the development of retractable bits that can be used either for rotary drilling or turbodrilling.

Reelable drill pipe. The idea behind this system is to make the drill pipe flexible so it can be reeled onto a drum as it is pulled from the hole.

Fig. 21 illustrates the principle of operation in one reelable drill-pipe system. In the original concept, a rubber hose was used as the drill pipe with the hose couplings designed so that the weight of the hose and bottom-hole drilling assembly could be taken by steel cables attached to these couplings. The couplings on the hose were also fixed so that as the hose was pulled out of the hole, the steel cables could be separated from the couplings and spooled up on separate drums. In this system, a bottom-hole mud percussor and an oscillator were used at different times during the development to drive the bit.

About 25 years ago, a total of 4,000 ft. of hole was drilled with this system to a maximum depth of about 2,000 ft. A related item of interest lies in Operation Pluto during World War II in which steel pipelines were laid across the English Channel by unspooling continuous steel pipe from a large floating reel.

The reelable-drill-pipe system shown in Fig. 21 became inactive about 20 years ago because of the lack of a suitable downhole motor for use with this system.

Continuous coring. This is not new in the industry, and has been used to a limited extent for special purpose jobs on various occasions by many different companies. Fig. 22 illustrates this concept which involves cutting only an annulus, rather than the entire hole bottom, and then breaking off the resultant core and circulating the core up the drill pipe to the surface. This corresponds roughly to a process known as trepanning in the metal-boring industry.

Recently, a Houston firm has begun using two-channel drill pipe to overcome the problems of increased annulus pressure (lost circulation) and core jamming problems which have, in the past, plagued reverse circulation coring. This firm has successfully recovered 1,400 ft. of continuous core and at present is actively continuing its development work.

Automatic rigs. The final system approach to be mentioned is that of rig automation. Humble developed a semiautomatic rig about 1950 to handle drill pipe when making trips to change bits. Object of this approach is to decrease trip time and crew fatigue.

Major components of Humble's semiautomatic rig, Fig. 23 included a lower pipe racker, an upper pipe racker, an air-operated elevator, and a traveling-block deflector to permit the traveling block to be moving vertically in the derrick while the pipe-racking tools are operating. Power slips and power tongs were used in the operation. This equipment was classed as semiautomatic because it simply replaced men's hands with steel "hands" and one man was still required to operate the controls at each position.

This equipment was developed from 1949 to 1953 and was field tested for

at least 1 year. During the field-testing work, over 75,000 ft. of hole was drilled. The project became inactive when experience indicated that maintenance and time for installation on rig moves resulted in excessive cost over and above the savings which accrued from use of the equipment.

International Drilling Machines is applying the concepts of machine-tool automation to the automation of a drilling rig. Fig. 24 shows a perspective drawing of the proposed mast for the automatic rig.

The rig will be completely automatic, electronically controlled, and hydraulically operated. The automatic functions of the proposed rig will include acceptance and rejection of drill string components and casing, cleaning of tool joints, making and breaking of tool joints, bit-weight control, drilling-fluid control, bit changes, and monitoring of cuttings for presence of oil or gas.

Design of this rig has been under development since 1952, and most work to date has been with models to test the functioning of various components or to establish design symmetry. The development is currently active and initial construction work is contemplated in the fall of 1960.

Additional science needed

From this review of industry's efforts to cut drilling costs through tool-development programs, it appears that industry may be approaching the point of diminishing returns in equipment developments aimed at preconceived end results. Industry has, to one extent or another, tried or is trying just about every generic approach that can be conceived, and yet has not been able to develop a drilling system generally more economic than rotary drilling. Furthermore, many of these approaches have been considerably refined by testing several variations without notable success to date.

Therefore, it appears that industry's problem is not a development problem, but a research problem. Research must perform its true function of evolving new information if industry is to make continuing significant long-term reductions in drilling costs. The needed new information lies in two areas: (1) theory and principles governing various subsurface rock failure processes, and (2) basic physical and engineering data relative to these processes.

To discuss in detail the basic and fundamental work that has been and should be done relative to earth boring would require another paper. (In the author's opinion, such a paper would render a much-needed service to the industry). However, it is instructive to list briefly such areas of fundamental study.

1. Rock properties under subsurface conditions.
2. Effect of state of stress on rock properties.
3. Borehole stress distribution.
4. Rock stresses resulting from bit action.
5. Means of changing borehole rock properties.
6. Mechanism of downhole chip formation and ejection.
7. Effect of fluids on chip formation and ejection.
8. Rate of loading effects in rock failure.
9. Mechanism of and factors controlling down-hole rock failure relative to percussors, rolling cutters, diamond bits, drag bits.
10. Energy required to remove a unit volume of down-hole rock by various attack methods.
11. Mathematical models that can be used to study and optimize bit action and rock failure.
12. Mechanics of rotary drill string action.

This listing in no way implies that the fields listed are virgin and untouched. To the contrary, some very good initial work has already been done in many of these areas, particularly within the last 2 or 3 years.

Conclusions

Effort on fundamental drilling studies should be accelerated and intensified to insure rapid and steady progress toward long-term drilling cost reduction. Fundamental studies will develop principles and engineering data that can hasten major rotary-drilling improvements as well as pave the way for systematic evolution of any new system that may be superior to rotary.

Some individual, through a flash of genius, may accomplish what the concerted effort of industry has thus far failed to do. But, this flash-of-genius approach cannot be predicted, directed, or controlled.

Thus, it appears that increased effort must be placed on systematic drilling research. Once research has developed adequate basic information, hardware development programs can then be initiated toward preconceived end results with the knowledge that such programs will have a very high probability of success.

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BY W. L. NELSON
Technical Editor and Petroleum Consultant

Questions on TECHNOLOGY

Construction, operating costs of LPG storage

Will you please send me references on the storage of liquefied propane or methane and especially the construction and operating costs? U.F.

Although there is much interest in the storage of gases at low temperatures as liquids, scarcely any commercial installations have been made.

The first commercial plant for the storage of liquefied methane (or natural gas) was completed early in 1941 by East Ohio Gas Co. at Cleveland.[13] The operation apparently was satisfactory and economical but in October 1944 the plant was destroyed by fire. Enormous losses of property occurred. As nearly as can be judged, no process failure occurred until fire released the liquid gas. A few years later a project for the delivery of liquid gas from Texas to New York by airplane was considered. Interest appeared among several organizations during 1952, especially in the transportation of liquid gases by barge or ship, but small-scale operation[11] did not occur until mid-1959. Large-scale operations are not expected before 1962.[11]

The storage of liquefied propane (—46° F.) at atmospheric pressure has been conducted since January 1957 by Atlanta Gas Light Co.[2] The cost of the tank is said to be one-third of the cost of pressure storage tanks, but this is partly offset by the cost of refrigeration and installation.

The only existing storage installation for natural gas is in the Soviet Union near Moscow and this plant has been in operation since 1954.[7]

All cost figures are quite approximate. Liquefaction plants, according to the literature, cost $196-$242 per M.s.c.f. per day but von Szeszich[18] thinks $300-$400 is more realistic. The cost of storage tanks also ranges widely, $6-$17 per M.s.c.f. but possibly as low as $3.50-$5.50 for large tanks.[18] Ocean-going tanker costs range widely but a figure of $700-$850 per ton of carrying capacity seems reasonable. Corresponding prices for liquefied propane carrying vessels is only $500-$600 per ton. Regasification plant costs are thought to be $7.50-$10.00 per M.s.c.f. per day.

Liquefaction costs without the costs of raw material, depreciation, or profit, appear to range from 8.5-11 cents per M.s.c.f. but the complete cost of liquefaction, handling, regasification, etc., ranges from 18 to 27 cents per M.s.c.f. including depreciation and return on investment.

Reference 7 states:

	Ct./M.s.c.f.
Processing, transportation and storage	21-55
Gas cost	3-25
Delivered cost	25-71

These costs contemplate various routes, such as from the Middle East, Caribbean, or Venezuela, to London—from Venezuela to New York, and from the Sahara to Marseilles.

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Equilibrium ratios for H_2S

In your Process Costimating No. 49, you estimated the amount of hydrogen sulfide in gasolines by using equilibrium ratios. Where can we find information on the phase behavior of hydrogen sulfide? P.H.G.

Listed below are a few references on hydrogen sulfide. One of the most useful of these is Ref. 1 (F. W. Winn) because it presents a nomograph of equilibrium ratios combined with a pressure-temperature grid which can be related to the convergence pressure of the system. Data are given for sulfide in gas oil, in naphtha, and in a crude oil. Obviously the application of equilibrium data to the wide variety of materials contemplated in Process Cost-imating No. 49 must be most approximate.

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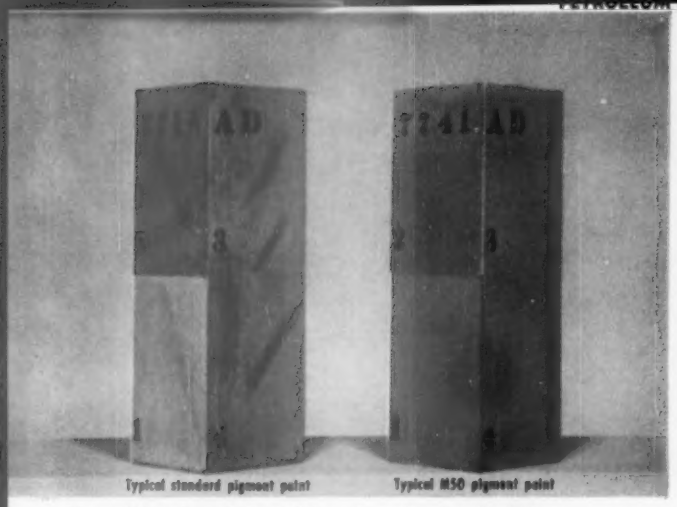
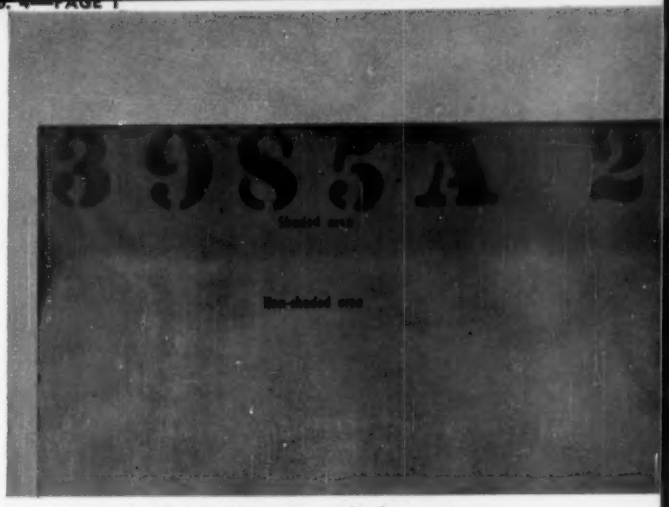


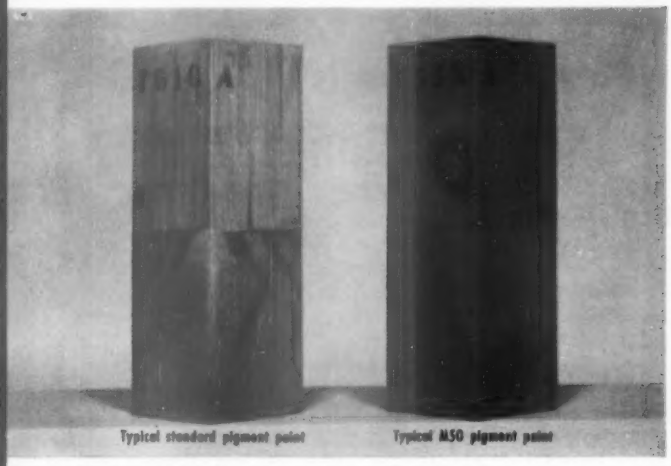
No objectionable whitening from chalking

Contrast these two exposure test panels . . . both show comparable metal finish paints. Same original colors. Same exposure (45° South, 2 yrs., 3 mos.). Notice bright color of *M50* paint, freedom from chalk.



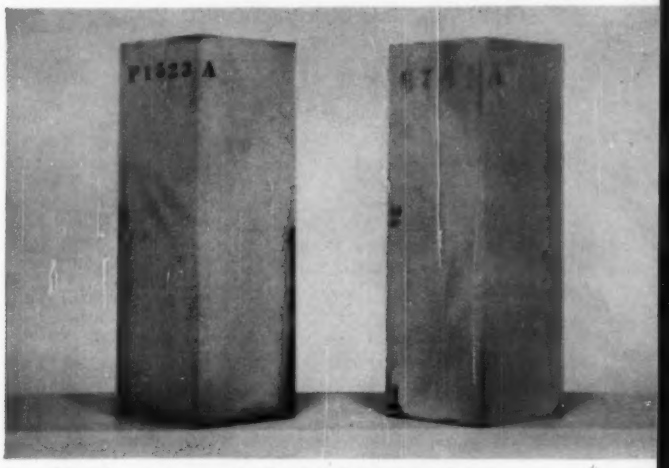
No appreciable fading from light action

Now look at this 9-year exposure test panel of an *M50* paint. Contrast area shaded by wooden panel holder with non-shaded area. Clearly, there has been practically no fading in this 9-year period.



No leaching from water action

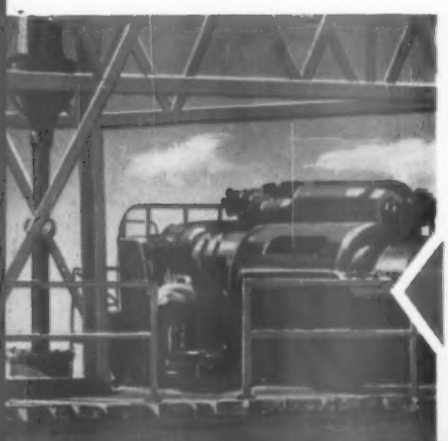
Examine the exposure panel at left. Notice the vertical brushmarks? Rain water leaching of the top coat permits brushmarks in undercoat to show through. In the panel at right, insoluble *M50* pigment prevents this film failure. Exposure 45° South, 2 yrs., 7 mos.



No discoloration in industrial atmosphere

Here are two exposure panels painted from the same can of *M50* paint. Both have been exposed 4 years, 45° South. The right one in normal atmosphere, the other in sulfur-laden industrial atmosphere. Notice no color difference has developed. No bilging.

Proof you get unique color stability in metal protective paints made with M50® pigment



Drilling equipment looks better, needs less maintenance painting when painted with colorful *M50* anti-corrosion paints.

No need to amplify what the four illustrations above show. Plainly, *M50* basic lead silico chromate pigment permits your paint supplier to make paints with more color stability than ever before available in anti-corrosion paints . . . primers as well as finishes.

National Lead exposure tests demonstrate that these paints . . . both standard and deep-coat . . . also provide better and longer lasting anti-corrosion action, and never-before weather resistance. Some of the opportunities these new *M50* paints present are suggested on the following page. You'll think of others.

M50 *an* **oncor** ® *pigment development of*

National Lead Company

111 Broadway, New York 6, N. Y.

Public relations.
Attractive tank farms that *stay* attractive longer.

Product identification.
Color-coded drums that *stay* colorful longer.

Two ways to make good use of the superior color stability of M50 pigment anti-corrosion paints

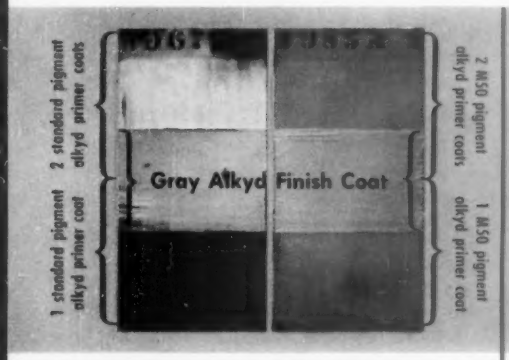
Before the advent of *M50* pigment, those responsible for maintenance painting had to make a choice between colorful appearance and long-lasting corrosion protection.

With *M50* pigment paints, exposure experience proves, this compromise is no longer necessary. *M50* paints have weather resistance . . . stay bright and colorful . . . and *at the same time* provide superior corrosion protection. With these unusual paints, color stability problems . . . leaching, fading, whitening, darkening from bilging . . . are eliminated. Now, with *M50* paints, you can have maximum anti-corrosion, maximum durability and, at the same time, long-lasting good appearance.

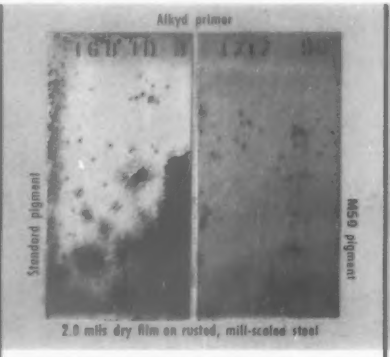
The illustrations above suggest two areas in which the combination of superior anti-corrosion action and superior color stability found in *M50* pigment paints can pay off handsomely. Note that in both, service is severe and colorful colors are needed. With *M50* paints, you repaint less often.

In your own operations there are bound to be many similar applications where specification of *M50* paints can lower your maintenance painting costs. Ask your regular paint supplier to make up suitable *M50* paints for your requirements.

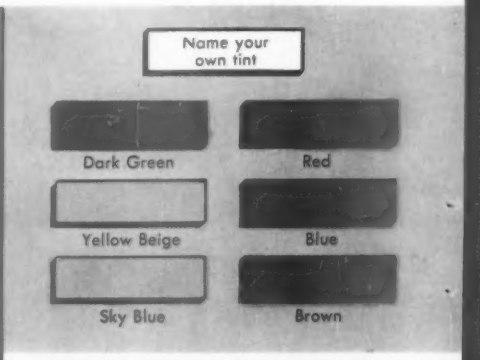
Why M50 Defense in Depth paints give anti-corrosion beyond all former concepts


2 standard pigment alkyd primer coats
1 standard pigment alkyd primer coat
Gray Alkyd Finish Coat
2 M50 pigment alkyd primer coats
1 M50 pigment alkyd primer coat

Exposed 9 years, 45°S. Each coat 1.5 mils
Proved corrosion and weather resistance



Exposed 45°S, 1 yr ind. atmos., 1 yr normal atmos.
Proved outstanding for film strength, durability



Colors above available in conventional and heavy-coat paints
A wide range of stable colors can be produced

Are you concerned with tank or structure maintenance painting in your firm? If so, you are invited: (1) to visit National Lead's Sayville, L.I. test station, where you will see the results of the 20 years research that lies behind the *M50* pigment particle and the more than 10 years of exposure testing that lies behind *M50* pigment Defense in Depth paints; (2) to send coupon below for National Lead booklet, "Defense in Depth" and typical *M50* tank paint specifications.

Next time you purchase, specify *M50* pigment paints. Any paint manufacturer can supply you.

M50 Defense in Depth

National Lead Company,
111 Broadway, New York 6, N. Y.

Gentlemen: Please send me the "Defense in Depth" booklet together with typical tank paint formulas and color chips that I can use in specifying M50-type tank paints.

Name_____ Title_____

Firm or Dept._____

Address_____

City_____ State_____

Operating costs—propane decarbonizing or deasphalting

BY W. L. NELSON
Technical Editor and Petroleum Consultant

THE MAIN variables in the cost of operating propane decarbonizing or deasphalting units is the amount of propane dilution, the type of refinery management, and the size of the installation. Larger dilutions are usually employed when producing lubricating oils but seldom as large as the 9 ratio used in Table 1 and Fig. 1. Costs decrease somewhat with larger units because of a saving in labor and investment, and somehow the smaller independent refiners are able to construct plants at much lower costs and they are able to operate with much less labor and supervision. Operating costs reported in the literature (1945-1959) converted to 1956 by the Nelson Operating Cost (Units) Index are shown in Fig. 1 except two very old references (1938) which indicate 1956 costs exceeding 60 cents per barrel.

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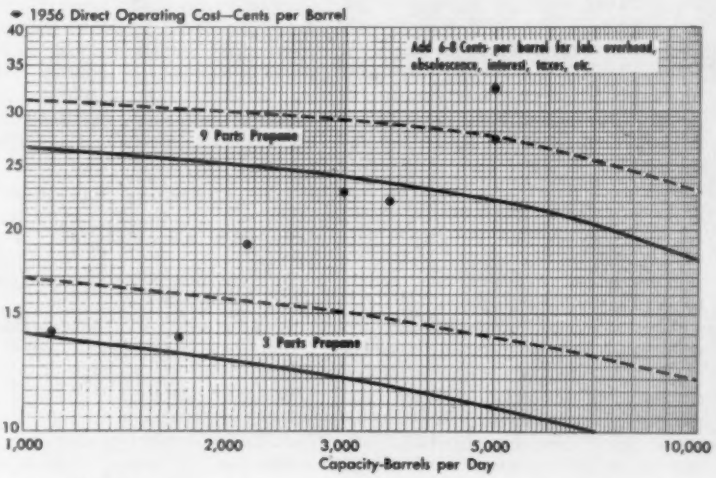


APPROXIMATE direct operating costs of propane decarbonizing or deasphalting plants (1956) of the flash type. Fig. 1.

TABLE 1—ELEMENTS OF OPERATING COSTS (PROPANE DEASPHALTING).

Element	Unit (somewhat standard)	1956 unit cost	For 3,000 B/D plant cts. per bbl. 3RR	9RR	See process costimating No.
Labor—Supervision	0.2-0.5 men/shift*	$3.85/hr.†	0.6- 1.5	0.6- 1.5	26, 28, 41, 42
Operating	1.5-4.0 men/shift*	$3.12/hr.†	3.7-10.0	3.7-10.0	
Maintenance	2-3% per yr. of replacement	$260-$400/daily bbl†	1.4- 2.2	2.2- 3.3	29
Fuel	45-110,000 B.t.u./bbl.¶	20-40 cts./M.M. B.t.u.	1.2- 2.3	2.6- 6.0	3, 4, 6
Steam§	70-140 lb./bbl.§	45-60 cts./M. lb.	3.1- 8.4	3.1- 8.4	17, 18
Electricity	0.8-2 kw.-hr./bbl.	0.85 cts./kw.-hr.	0.7- 1.0	1.1- 1.7	13, 14
Cooling water	34-90,000 B.t.u./bbl.	1.7 cts./M. gal.	0.3- 0.5	0.4- 0.6	15, 16, 38
Propane	0.15-0.4 gal. lost/bbl.	3-7 cts./gal.	0.4- 1.7	0.8- 2.8	
Direct operating costs (probable extremes)		.....	12-24	15-29	
Obsolescence, ins., taxes, interest, etc., 7% per year of replacement		$260-$400/daily bbl.†	5-6.5	6-7.7	
Laboratory overhead 0.3-0.7 men/shift		$3.12/hr.†	0.6-1.6	0.6-1.6	26
Other costs (probable extremes)		.....	6-8	7-8	

*Major operators use a larger amount of labor and pay more for their plants.
†Average U. S. wages plus 27% for all burdens.
‡For three parts and nine parts of propane mixed with oil.
§No stream used for heating, and substantially all pumping by electric power.
¶Heat absorbed. Divide by furnace efficiency for heat generated.

The Fluor solvent CO_2-removal process

● The Fluor solvent CO_2-removal process represents a new approach to the problem of purifying high-pressure gas streams rich in CO_2. The process is exceedingly simple and, as will be shown here, the economics are quite favorable compared with other available processes.

BY A. L. KOHL AND
P. A. BUCKINGHAM
The Fluor Corp.

RESEARCH aimed at developing a more economical CO_2-removal process was started by the Fluor Corp. a number of years ago. At that time the principal available techniques for CO_2 removal were the water wash and monoethanolamine processes. Since initiation of the project, the need for a better process has greatly increased, due primarily to the expanding use of natural gas which has required the development of reserves rich in carbon dioxide. Also, the appearance of new CO_2-removal methods, notably the hot potassium carbonate and the Giammarco-Vetrocoke processes, has indicated that others too recognized the problem.

The principal drawback of the water-wash process is its very high energy requirement for pumping, which results from the relatively low solubility of CO_2 in water. The ethanolamine process, on the other hand, suffers from an excessive heat energy requirement for stripping when large quantities of carbon dioxide are handled, as a result of the high heat of reaction between carbon dioxide and monoethanolamine. The research program, therefore, was aimed at developing a process which combined the low heat energy requirement of the water-wash process with the low pumping requirement of the amine process. The program was outstandingly successful and it is the purpose here to describe the process developed and present economic data which will permit an evaluation of its merits.

Process Development

Preliminary analysis of the problem indicated that the desired objectives could best be met by the use of a substantially anhydrous, nonreactive organic solvent as an absorbent for carbon dioxide. An operation based on physical solution rather than chemical reaction would eliminate or greatly reduce heat requirements for stripping and, if a solvent with sufficient capacity for CO_2 were found, the circulation rate and therefore the pumping requirements could be minimized. The initial studies showed that the development of a suitable solvent would not be a simple matter. In addition to the obvious requirement of a high capacity for CO_2, the following requirements were found to be important for any solvent to be considered seriously as the absorbent in a commercially practical CO_2 removal process:

1. Extremely low vapor pressure at operating temperature.
2. Low solubility for the primary constituents of the gas stream, e.g., hydrocarbons and hydrogen.
3. Low viscosity.
4. Low hydroscopicity.
5. High stability under operating conditions.
6. Nonreactive with all components in the gas.
7. Noncorrosive to common metals.
8. Readily available at a reasonable cost.

The initial period of research consisted primarily of screening literally hundreds of possible solvents and selecting the most likely candidates for testing in a bench-scale gas-purification pilot plant.

During the screening period, process design studies were made to aid in the selection of optimum solvents by eliminating those which resulted in uneconomical plant designs. These analyses clearly indicated that, if the objective of a low-cost CO_2-removal process were to be met, process complexities must be avoided. This emphasized the importance of low solvent vapor pressure. For example, several high-vapor-pressure solvents have very high capacities for CO_2, yet these were ruled out because they require additional equipment for low-level refrigeration, solvent vapor recovery, and absorbed hydrocarbon recovery. In addition, operation at very low temperatures requires special precautions to prevent hydrate formation and minimize heat losses. The studies also showed the importance of low hydrogen and hydrocarbon solubility; in fact, the solubility ratio of CO_2 to hydrocarbons was found to be almost as important as CO_2 solubility itself for natural-gas purification because of the high cost of hydrocarbon losses or the expense of plant modifications required to minimize them.

The use of subambient temperature is not always undesirable; in fact, op-

Presented at the thirty-ninth annual convention of Natural Gasoline Association of America, April 27-29, 1960, Houston.

The authors . . .

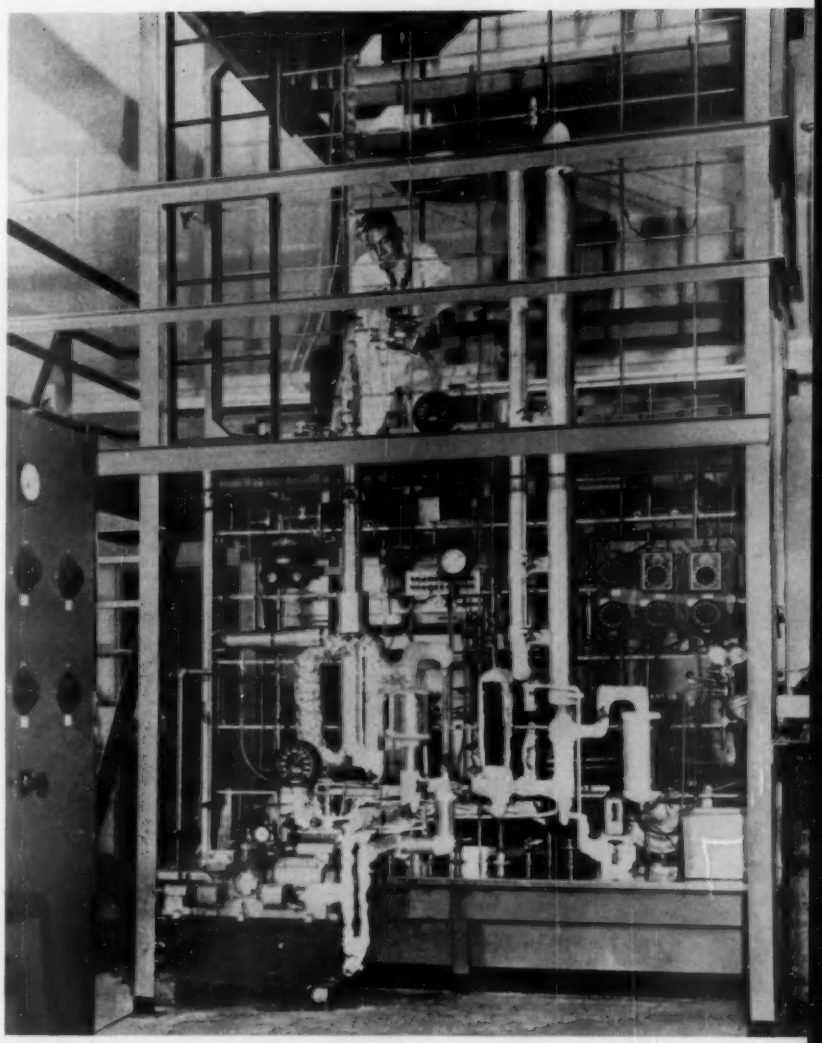
Chief Research Engineer Kohl conceived and supervised the development of the Fluor solvent CO_2-removal process. A graduate of University of Southern California, he also won an MSChE degree there. Kohl worked in research and development with Turco Products and served in the Army prior to joining Fluor in 1947. His service with the company has included directing research on chemical and petroleum processes. He is a member of AIChE and ACS, and he is a registered professional engineer in California.

Process Development Engineer Buckingham worked on the design optimization and commercialization of the Fluor solvent CO_2-removal process. He holds a BS degree in chemical engineering and an MS degree in meteorology from MIT. Following 4 years in the Air Force as a meteorologist, he was employed by Merck & Co. Buckingham joined Fluor in 1956, where he has engaged in the evaluation and commercialization of new chemical and petroleum processes. He is an AIChE member.

eration at a moderately low temperature is often advantageous. In treating high-pressure natural gas, an appreciable amount of net refrigeration is available due to the expansion of high-pressure CO_2 from the pressure of absorption to atmospheric pressure. Because of this, it is quite possible to operate the process at a moderately low temperature without the inclusion of a complex, large-scale refrigeration cycle. Since, for all solvents tested, CO_2 solubility increases and solvent vapor pressure decreases with decreased temperature, it is generally economically attractive to take advantage of the "free" refrigeration. Unfortunately, solvent viscosity invariably increases with decreased temperature, and with some solvents this factor can effectively prevent operation at an otherwise economical low temperature. The viscosity of a solvent has a direct effect on process economics because it influences column size and the mechanical efficiency of pumps.

Hygroscopic liquids are undesirable because of the effect of dissolved water on other factors. Most important, water in the circulating solvent generally reduces its capacity for carbon dioxide. Dissolved water also tends to increase corrosion and solvent decomposition. With hygroscopic solvents it is necessary to prevent the buildup of water by dehydrating the feed and stripping gas streams or by dehydrating a slip stream of the circulating solvent. This, of course, increases process complexity and plant cost.

The problems of solvent breakdown, reaction with other components present, and corrosivity are closely related, as they are all influenced by the general chemical reactivity of the solvent. They also are interrelated because solvent breakdown or reaction, if it occurs, can result in the formation of corrosive compounds. During the initial laboratory phase these factors were generally evaluated together for selected solvents by subjecting them to extended tests simulating the process cycle. Specific reaction rates also were studied for solvents with such important reactants as oxygen and hydrogen sulfide. With the final selected group of solvents, corrosion and decomposition were found to be almost negligible factors. Carbon steel was shown to be a satisfactory construction material for all parts of the plant. Carbon dioxide and hydrogen sulfide are the most corrosive components usually present and their activity is minimized by the operating conditions of the process, particularly the low water content of the solvent, and the relatively low temperatures through the entire flow cycle.



BENCH-SCALE PILOT PLANT was used for final evaluation of selected solvents. Fig. 1.

The bench-scale pilot plant used for final valuation of selected solvents is shown in Fig. 1. In this pilot plant the absorber, which is visible on the right, consisted of a 1-in.-diameter stainless-steel pipe packed with 7½ ft. of ¼-in. glass Raschig rings. The stripping column shown in the figure (center left) was a vacuum jacketed glass Oldershaw-type bubble-plate column. The unit was also operated with a packed stripping column and with other modifications to test the effectiveness of vacuum stripping, stagewise flashing, and inert-gas stripping. Solvent was recirculated by the high-pressure pump shown in the left foreground to the desired absorber feed point. As a result of these research studies, several plant designs were prepared using different solvents and flow arrangements, the optimum solvent and flow arrangement for each case being dependent upon operating conditions and performance requirements. These designs showed outstanding promise for commercial applications.

Patent applications were filed on many features of the process. Three patents recently have been issued[1 2 3] which cover the solvents, propylene carbonate, glycerol triacetate, butoxy diethylene glycol acetate, and methoxy triethylene glycol acetate when used for the absorption of carbon dioxide from high-pressure gas streams. Several process flow schemes also are described.

El Paso Natural Gas Co. joined Fluor in the commercial development of the process for application to a natural gas containing a very high carbon dioxide concentration. Additional bench-scale tests were conducted to duplicate the expected field conditions and then a large field pilot plant was constructed by El Paso Nat-

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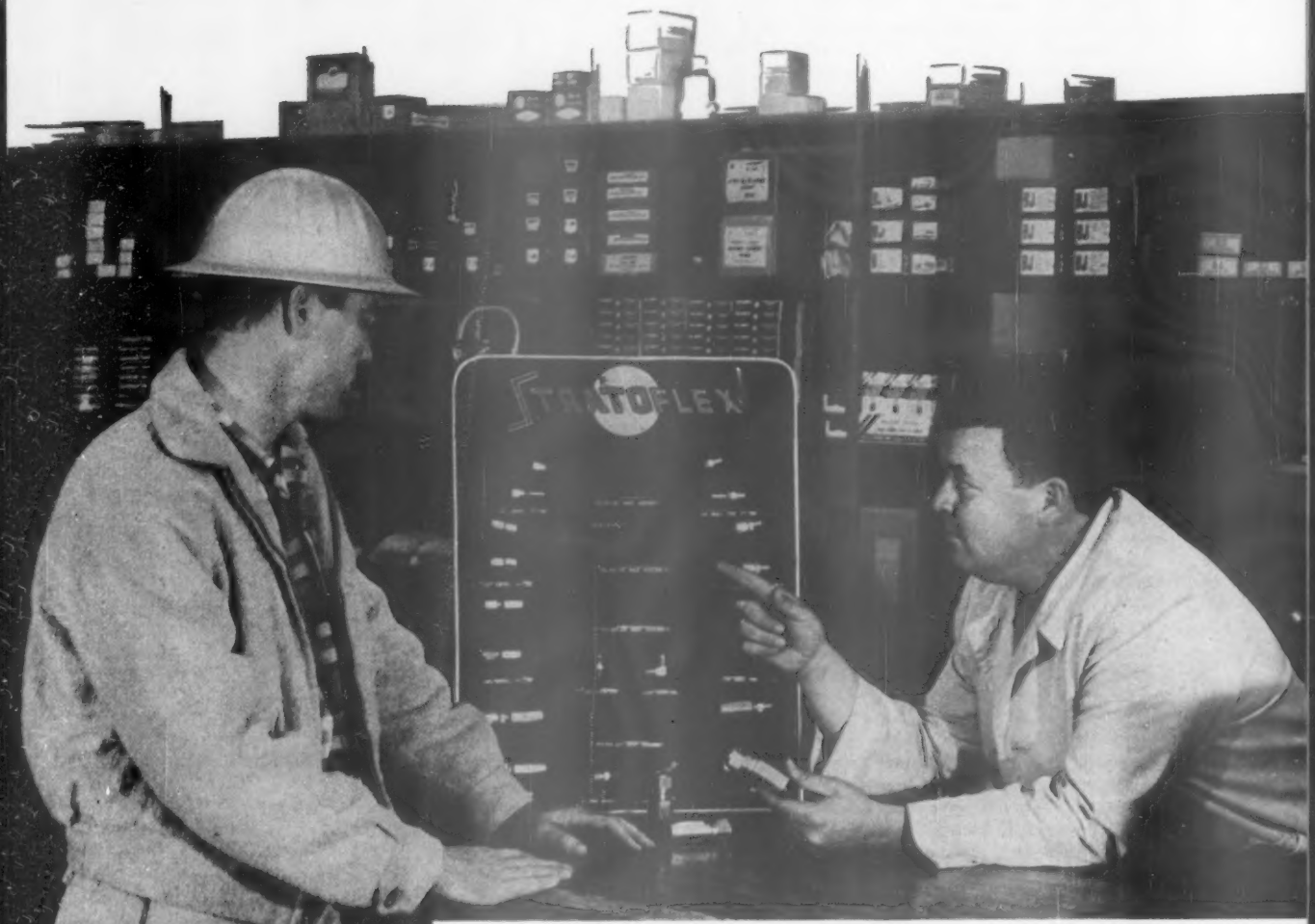

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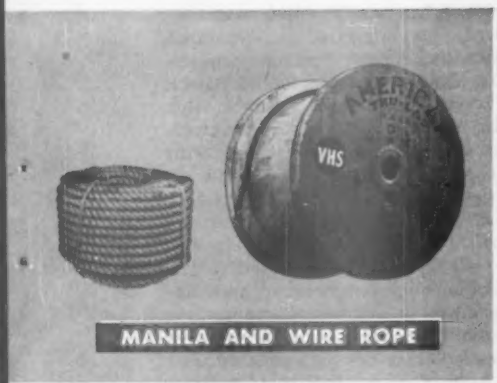

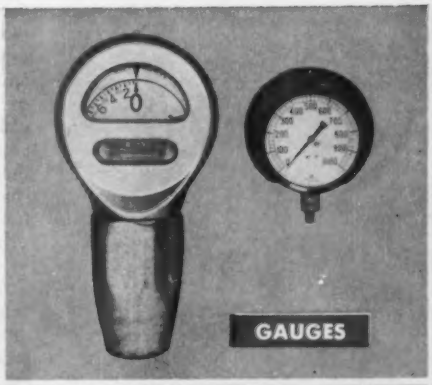

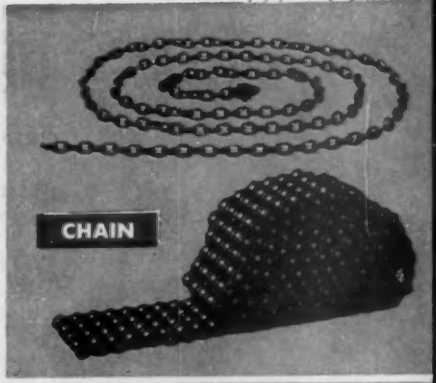

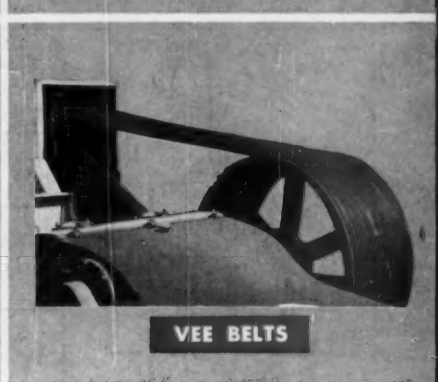

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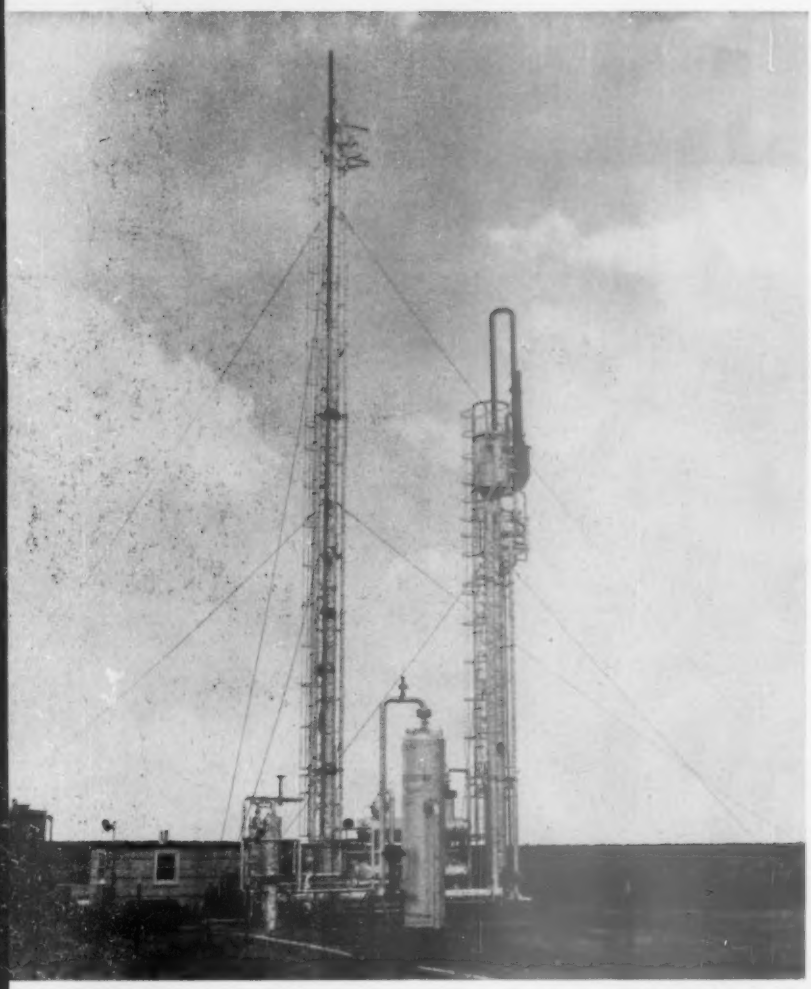
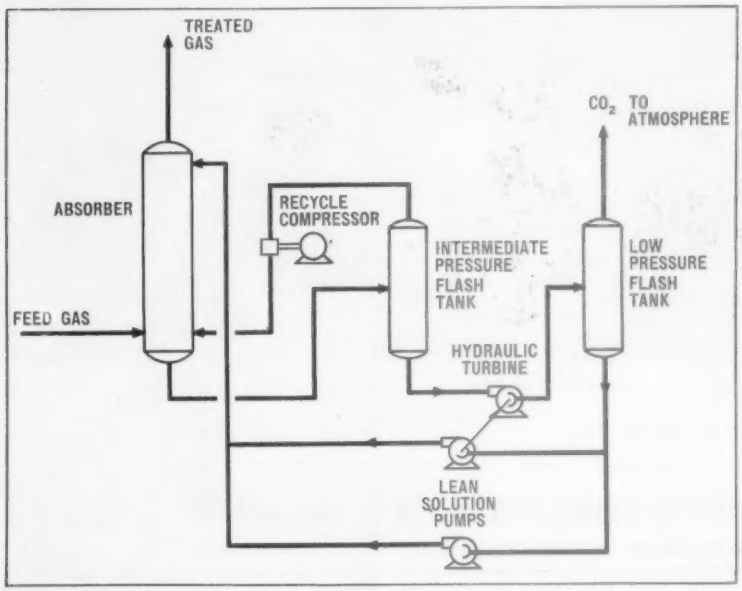


FIELD PILOT PLANT used for testing Fluor solvent CO_2 removal process. Fig. 2.



NEW PROCESS has simple flow pattern. Gas is contacted with solvent in a conventional countercurrent absorption column. Fig. 3.

ural in Terrell County, West Texas. A photograph of this plant is shown in Fig. 2.

The field pilot plant, which had a nominal capacity of approximately 1.5 M.M.s.c.f.d. of input gas, was found capable of reducing the carbon dioxide content of the gas from about 53% to less than 3% without the use of vacuum or stripping vapor in the regeneration step and to less than 0.25% when air stripping was employed. The effects of such variables as absorber height, operating temperature, flow arrangement, and nature of solvent were investigated in this plant. In general, process performance checked remarkably well with that predicted from the bench-scale studies and provided firm design data for commercial plants.

Process Description

Commercial designs have been developed for a number of applications of the Fluor solvent CO_2 removal process. These designs employ different solvents, operating temperatures, and flow schemes, depending upon the specific requirements and conditions. A simplified flow diagram for a typical Fluor solvent CO_2 removal process plant is shown in Fig. 3. The CO_2-rich gas is contacted with solvent in a conventional countercurrent absorption column. Lean solution is fed to the top of this column at ambient or slightly subambient temperature and it leaves the bottom rich in CO_2 and somewhat warmer, due to the heat of absorption. In addition to CO_2, the solvent absorbs water vapor, hydrogen sulfide, and mercaptans, if present, and a small quantity of hydrocarbons from the gas stream. The rich solution is flashed to an intermediate pressure to release a major portion of the dissolved hydrocarbons and the resulting gas is compressed and recycled to the bottom of the absorber. The solvent which is still at a relatively high pressure is next passed through a power-recovery turbine to the atmospheric pressure flash vessel from which the desorbed CO_2 is vented. Water, hydrogen sulfide, and mercaptans are stripped from the solvent by the large volume of carbon dioxide, so that an appreciable net removal of these components is also accomplished by the process. The solution cools during the stripping steps because of the heat released by CO_2 desorption and expansion. Cool lean solution is recycled to the top of the absorber.

In the flow scheme shown, regeneration is effected by atmospheric pressure flashing, so that the lean solution leaves the regeneration step in approximate equilibrium with carbon dioxide gas at 1 atm. pressure. Since the lean solution returned to the ab-

sorber contains carbon dioxide equivalent to 1 atm. partial pressure, it obviously cannot reduce the carbon dioxide content of the treated gas below this level. At 800 psig., for example, this means a minimum carbon dioxide content in the treated gas of about 2% with the flow diagram shown. If a lower level of carbon dioxide is required, air or other inert gas may be used for stripping, or vacuum flashing may be employed. Since only the carbon dioxide left in solution after atmospheric flashing must be removed under vacuum, the power requirement for this operation is nominal and can be further reduced by removing CO_2 in two or more subatmospheric stages. Air stripping requires even less power than vacuum flashing but suffers from the possible disadvantage of introducing a trace of oxygen into the treated gas. Perhaps the most economic regeneration procedure, where a very low CO_2 concentration in the product gas is required, is to use air stripping to remove the CO_2 followed by vacuum flashing to remove dissolved oxygen. In this case, only a minor amount of power is required in the vacuum step because of the very small amount of dissolved air which must be desorbed and compressed to atmospheric pressure.

Gas, which is flashed off in the intermediate pressure flash step, is rich in hydrocarbons and may be handled in a number of ways. Recycle to the bottom of the absorber, as shown in the flow diagram, is perhaps the simplest if the gas cannot be used locally as a low-B.t.u. fuel. The theoretical efficiency of the recycle step can be improved by feeding the recycle gas into the absorber at a point below the main gas inlet. This results in a reduction in required solution flow rate at the expense of absorber height. Alternatively, the intermediate-pressure flash gas may be contacted with a separate stream of solvent before recycle, and then admitted to the primary absorber at a point above the main gas inlet. This system results in a smaller recycle compressor (because most of the CO_2 is removed before compression) and reduces the size of the primary absorber by reducing the required liquid rate and decreasing the gas velocity at the bottom of the absorber where gas flow rate normally is highest. Over-all hydrocarbon recoveries on the order of 98% are readily attained using recycle schemes such as described above.

Details of the flow scheme may be varied to permit operation at the temperature level which is optimum for any particular set of conditions. When subambient temperature operation offers advantages, it is generally necessary to extract heat from the system at one or more points and it is most economical to remove the heat from relatively warm streams. Typically, this is accomplished by the use of heat exchangers for cooling the rich solution from the absorber, the feed gas, and the recycle gas after compression. If a relatively low-temperature level is desired, it often is economical to use the cold product gas and CO_2 streams as coolants, while the use of cooling water may be adequate for operation near ambient temperature.

In the flow arrangement illustrated, a hydraulic turbine is employed to extract energy from the solvent during pressure reduction from the intermediate flash pressure to atmospheric pressure. Depending upon economics, turbines may also be justified to remove work energy during the initial pressure reduction or between intermediate flash stages, if these are used. Additional energy recovery may be obtained by passing gases, flashed from the solution at intermediate pressures, through a gas expansion turbine.

TABLE 1—PLANT SPECIFICATIONS FOR COMPARING CO_2 REMOVAL PROCESSES

Plant capacity, M.M.s.c.f.d. feed gas	110
Feed-gas pressure, psig.	800
Feed-gas composition:	**Vol. %**
CO_2	53.2
N_2	0.7
CH_4	45.7
C_2H_6	0.4
H_2S	nil
Mercaptan	nil
H_2O	70° F. dew point
Treated-gas specifications:	
CO_2	2% max.
H_2O	32° F. max. dew point

Process Economics

The Fluor solvent CO_2 removal process is intended primarily for the purification of gases containing CO_2 in high concentrations at high pressures. Hydrogen sulfide and mercaptans do not interfere with the process and, in fact, simultaneous removal of an appreciable percentage of these impurities with the CO_2 is realized. The process is most economical for gas streams which are quite dry with regard to heavier hydrocarbons because

TABLE 2—BASIS FOR ESTIMATING PLANT OPERATING COSTS

Direct Costs

Fuel gas	$0.16/M.M. B.t.u.
Process water	0.10/M. gal.
Chemical losses	Current prices
Operating labor	Operators, $2.75/hour; Foreman, $3.50/hour: plus 22% burden to cover insurance, vacation and other benefits.
Maintenance	Annually 4% of plant investment; typically 60% labor and 40% materials.
Plant general	Annually 40% of total direct labor cost, includes nonoperating services and personnel up to and including plant manager.

Indirect Costs

Depreciation	Annually 10% of plant cost
Taxes and insurance	Annually 2.5% of plant cost
Interest	Annually 3% of plant cost

TABLE 3

	Fluor solvent	Giammarco-Vetrocoke (air stripped)	Hot potassium carbonate	Water wash
Plant investment*	$2,400,000	$3,900,000	$4,600,000	$4,800,000
Direct operating costs:				
Fuel gas	130,000	90,000	590,000	206,000
Process water	1,000	5,000	2,000	1,000
Chemical losses	18,000	10,000	6,000	1,000
Operating labor	96,000	96,000	96,000	96,000
Maintenance	104,000	156,000	172,000	192,000
Plant general	62,000	74,000	78,000	83,000
Total direct costs	411,000	431,000	944,000	579,000
Indirect operating costs:				
Depreciation	240,000	390,000	460,000	480,000
Taxes and insurance	60,000	98,000	115,000	120,000
Interest	72,000	117,000	138,000	144,000
Total indirect costs	372,000	605,000	713,000	744,000
Total operating costs	783,000	1,036,000	1,657,000	1,323,000
Treating costs, $/M.s.c.f. feed	$0.020	$0.027	$0.043	$0.034

*Includes royalty and initial chemical charge.

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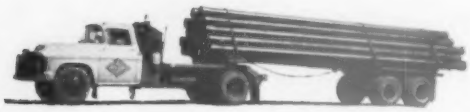

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of the solubility of these components in the solvents used. Absorbed methane and ethane can be largely recovered by the intermediate flash and recycle but an appreciable portion of the propane and heavier hydrocarbons may be lost with the carbon dioxide unless special steps are taken to recover them. Since these steps add to the plant costs, the process becomes less attractive for "wet" gas streams. Hydrogen and nitrogen are very sparingly soluble in the solvents so the process is very attractive for synthesis gas purification where sufficiently high CO_2 partial pressures are encountered.

To illustrate the advantage of the new process in one application, an economic comparison of the Fluor solvent CO_2 removal process with the hot potassium carbonate, Giammarco-Vetrocoke, and water wash processes has been made. Plants have been designed to use each of these processes for purifying the same high-CO_2 natural-gas stream, and first cost and operating costs have been estimated for each. Operating conditions and requirements which form the basis of the plant designs are given in Table 1.

It will be noted that the gas is quite dry with regard to heavy hydrocarbons, and is free of H_2S and mercaptans. This composition was chosen to simplify the analysis; however, the results would not be greatly altered by a minor increase in the quantity of ethane and heavier hydrocarbons, or by the presence of a small amount of sulfur compounds. The feed gas contains 53.2% CO_2 and has a 70° F. water dew point. All of the plants were designed to produce a treated gas containing 2% CO_2 with a maximum water dew point of 32° F. Under the conditions of this example, the Fluor solvent process does an adequate dehydration job, while all of the others add water to the gas and, therefore, require separate dehydration steps. The cost of these dehydration units is included. Detailed flow diagrams of the hot potassium carbonate, Giammarco-Vetrocoke, and water-wash processes are not presented because these processes have been adequately described in previous publications.[4 5 6]

The basis for estimating treating costs by the various processes is presented in Table 2 and results of the economic comparison are summarized in Table 3. For the case considered, the Fluor solvent process is appreciably more economical than any of the others with regard to both plant investment and operating cost, and the Giammarco-Vetrocoke process is second with regard to both items. The hot potassium carbonate process shows the next-lowest plant-investment cost, but it is less economical than the

water-wash process with regard to total operating cost. The indicated treating costs vary from a low of 2.0 cents per M.c.f. of feed gas for the Fluor solvent process to a high of 4.3 cents for the hot potassium carbonate process. It should be noted that a fifth process, the well-known monoethanolamine process, could also be used for the required gas purification; however, previous studies have indicated that it would not be competitive with even the hot potassium carbonate or water wash processes for the case studied.

Both the feed composition and product gas specifications have a major effect on plant costs and, in fact, on establishing the optimum process. For example, the Giammarco-Vetrocoke process can provide a lower CO_2 concentration in the product at little extra cost, while the Fluor solvent process might require a second gas-purification step or a more expensive solvent-stripping operation if an appreciably lower product gas CO_2 content is required. On the other hand, if the product-gas CO_2 specification is relaxed (to say, 3% CO_2), the Fluor solvent process becomes even more attractive because the vacuum flash step used in the case studied could be omitted. At higher CO_2 partial pressures in the feed gas, the Fluor solvent process shows a greater advantage over the other processes studied and, at lower CO_2 partial pressures, the Giammarco-Vetrocoke process becomes progressively more attractive. Preliminary analysis indicates that the Fluor solvent process would continue to be the most economical method for removing CO_2 from a gas of the type studied down to a CO_2 partial pressure of less than one-half that used in the example.

If other conditions are not changed, the presence of H_2S in the feed gas favors the Fluor solvent process over Giammarco-Vetrocoke because the latter requires that H_2S be removed in separate additional equipment ahead of the CO_2-removal unit. The presence of heavy hydrocarbons in the gas, on the other hand, swings the economic advantage toward Giammarco-Vetrocoke.

The natural-gas, petroleum, and chemical industries pose many acid-gas-removal problems, which differ with regard to feed-gas composition, product specifications, and other important design factors. No one process can be expected to provide the optimum solution to all of these problems and many excellent purification schemes are available for consideration in each case, including the Giammarco-Vetrocoke, the hot potassium carbonate, water-wash, and ethanolamine processes. The new Fluor sol-

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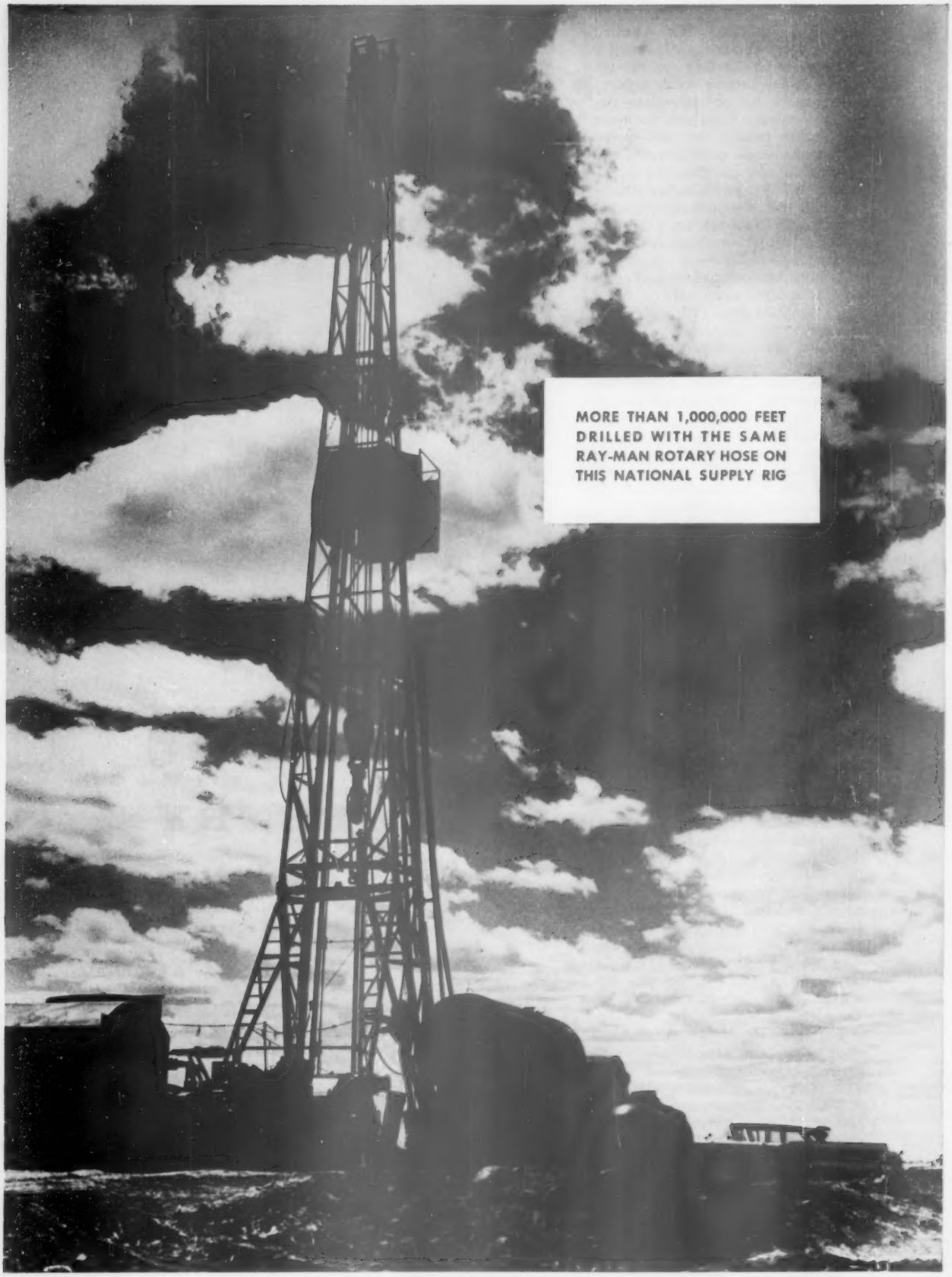
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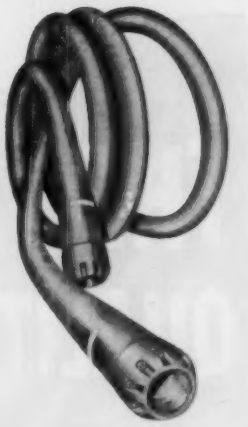

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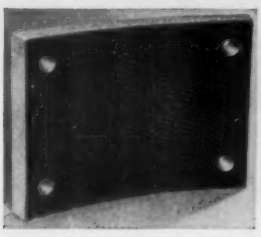

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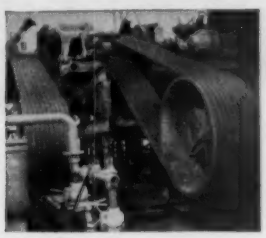

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vent CO_2-removal process can now be added to the list, and for certain problems this new process offers very substantial economic advantages.

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BOOKS

THERMODYNAMIC PRINCIPLES FOR CHEMICAL ENGINEERS. By Roger Gilmont. Published by Prentice-Hall, Inc., Englewood Cliffs, N. J. $11.00. 339 pp.

This is a basic textbook in thermodynamics. It develops the material from fundamental principles, and it emphasizes these principles rather than applications. Only prerequisite mathematics, up to and including differential equations, is used. Nevertheless, all of the fundamental relationships are rigidly developed. Group solution of problems is encouraged where it eliminates tedious calculations, such as in the construction of charts. Illustrations are clear and equations are well represented. There are discussions of free energy, homogeneous equilibrium, heterogeneous equilibrium, phase rule, first and second law, chemical potential, vapor-liquid equilibria, measurement of entropy changes, and there is an introduction to irreversible processes. An appendix includes a discussion of determinants, graphical calculus, partial quantities, and a derivation of the ideal gas law. There are 84 problems. These are intended to illustrate the important points, yet keep the number of problems to a minimum.

MICROSCOPIC SEDIMENTARY PETROGRAPHY. By Albert V. Carozzi. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. 485 pp. $11.50.

The author supplies the reader with "ideal" descriptions which summarize both the most common appearances of a sedimentary rocktype and those variations which have broad significance.

These ideal types have been achieved through a combination of as many descriptions of a given rocktype as the author could find in the American and European literature on the subject (references are given to these various descriptions).

In this way, the reader is given information on the different rocktypes without becoming embroiled in detailed descriptions of local significance.

Among the special features of the book is a thorough coverage of cementation processes in sandstones, complete microscopic description of argillaceous, carbonate, and evapostic rocks, and advanced discussion as well as detailed description of sedimentary rock types.

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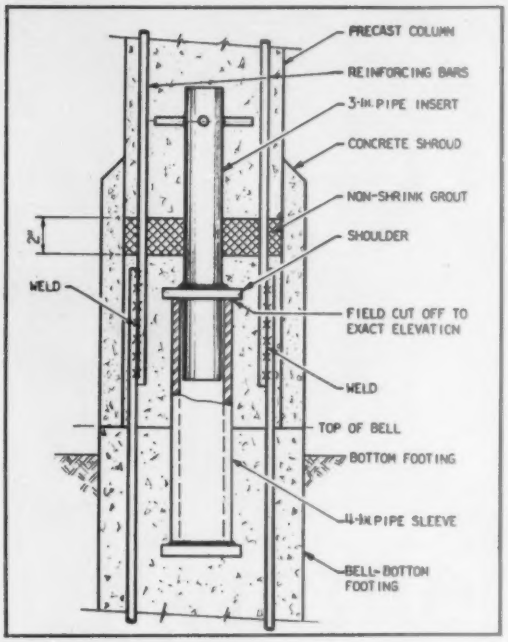
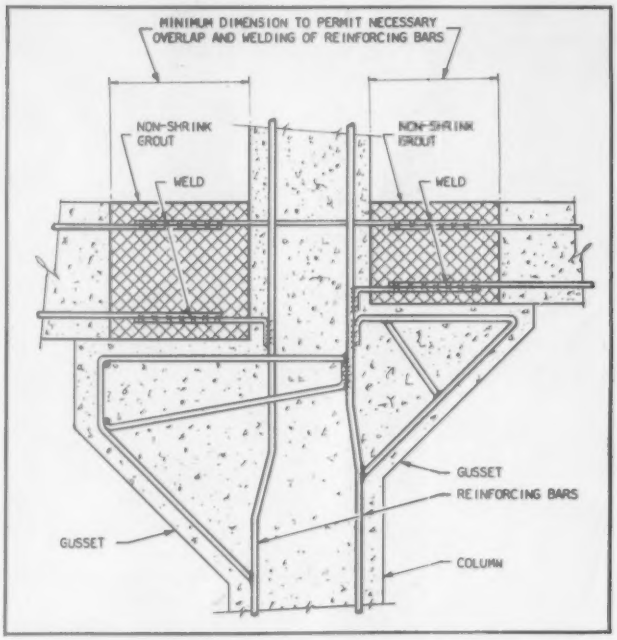


VERTICAL CONNECTION for precast columns using new type joint. Fig. 1.



HORIZONTAL CONNECTION for precast beams using new type joint. Fig. 2.

New, fast, economical joint makes

USE OF PRECAST concrete is becoming an increasingly popular method for building economical structures previously erected from structural steel and cast-in-place concrete. The rising cost of steel construction and improvement in concrete materials and methods are causing a trend toward concrete structures. Precast concrete has found favor because of improved quality control and extensive savings resulting from simplified form requirements.

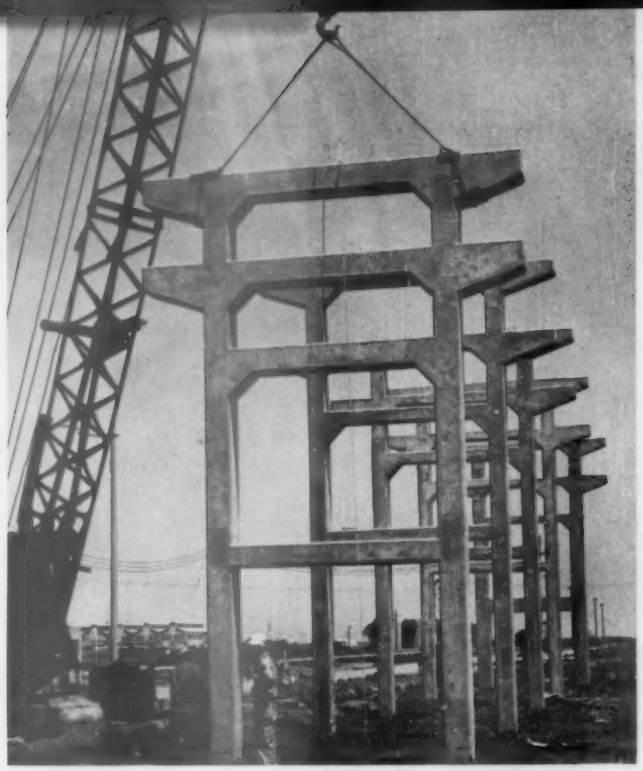
Further, precast concrete can cost up to 30% less than other materials for structural installations provided field handling and assembly problems for heavy precast members can be overcome. It is, therefore, apparent that a fast and efficient field joint between precast members is needed that will provide the assembly speed which heretofore has been common only to structural steel.

An efficient method of connecting a precast reinforced vertical or horizontal member to another concrete structure (patent pending) has now been made available to the construction industry by Shell Chemical Corp. This method of connecting concrete members solves a problem which has confronted both designers and constructors of precast concrete structures. Details of a typical joint are illustrated in Fig. 1 for any vertical connection and in Fig. 2 for horizontal beam connection; however, the method can be used by precast concrete designers to suit the application required.

The advantages of precast concrete structures are now considerably improved by the addition of this new joint which is 100% efficient. Also, it has a monetary savings of approximately 60% per joint over the conventional bolt-and-plate connection. For example, based on comparable joint efficiency for a 16 by 16-in. precast column there is a saving of $85 per joint in favor of the new joint (see typical cost comparison, Table 1).

Design. One of the problems confronting designers of precast concrete structures has been how to connect the precast members when erecting the structure. The connection or joint between two or more of the precast members must provide for the flexure, shear, and bond conditions over the cross-sectional area of the joined members. The reinforcing steel must assume the loads resulting from tension and shear and a proportionate part of the compressive load. The design must also provide that the concrete assumes its proportionate part of the compressive load and the completed joint must be free of possible high localized stresses.

Installation. The typical joint details shown in Fig. 1 illustrate the method of connecting a precast reinforced concrete column to a reinforced bell-bottom foundation. Reinforcing bars are located in both the foundation and the precast member in similar geometric patterns so as to be substantially in alignment when the structures are placed in position. All of the bars should overlap enough so that when welded together the connection will develop the full tensile strength of the reinforcing steel. Control of the space between the top surface of the foundation and the lower surface of the column in Fig. 1 is obtained by embedding a 4-in. pipe in the foundation in such a manner



CHEAPER than an equivalent steel structure, this precast structure required no more construction time. Fig. 3.

precast concrete practical

BY MYLES H. R. COGAN
Shell Chemical Corp.
Houston

that the top end of the pipe can be cut off accurately at a predetermined elevation.

A 3-in. pipe is embedded in the lower surface of the column and a lug or ring is attached to the outside of the pipe in a predetermined position. The elevation and orientation of the column with relation to other structures will be determined upon erection when the 3-in. pipe in the column is inserted into the 4-in. pipe in the foundation, and the shoulder of the lug or ring rests on top of the 4-in. pipe. The bars and pipe in both the foundation and the column can be set in their proper position by means of templates before the concrete is poured.

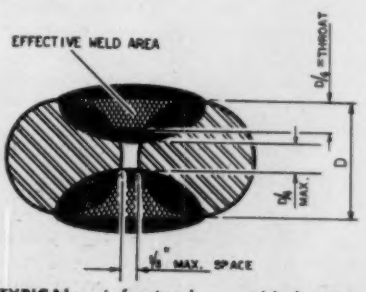
Alignment and positioning of the structural members to be connected in any position can be done either by the method described above or by other means, such as leveling jacks, screw adjustments, or similar simple devices.

After the column has been positioned over the foundation, Fig. 1, the overlapping reinforcing bars are welded together as previously described. The intervening space or gap between the exposed surfaces of the concrete is then filled with concrete of compressive strength equal to that used to pour the precast column, leaving a 1¼ to 1½-in. void under the column for grouting. After this concrete has set, the void is then packed with a nonshrink grout. The grout should be tamped in using either a stiff or plastic mix. The joint is finished by applying a concrete shroud.

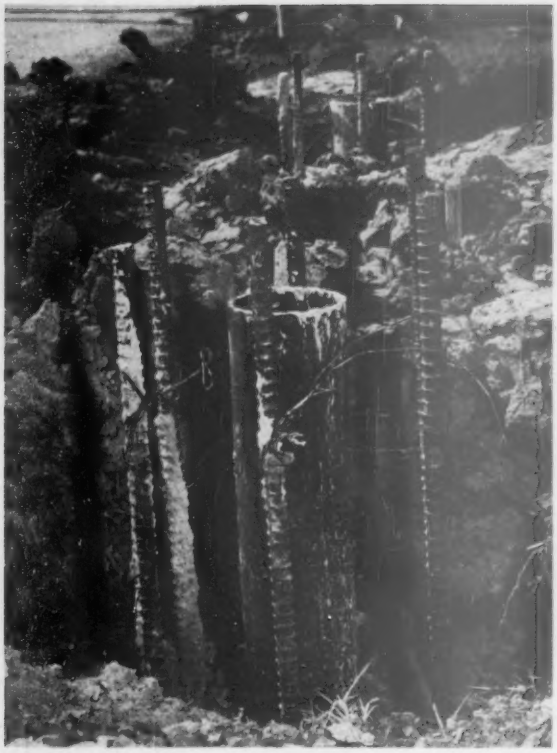
Joint efficiency. A 100% efficient, economical connection between reinforced precast concrete structural members is now available to the industry. According to the manufacturer of the nonshrink grout the expansion at 28 days will be 0.00125 in. per inch for a stiff mix, and 0.001 in. per inch for a plastic mix. This expansion of the grout will prestress the reinforcing steel in the connection to a small extent. With a modulous of elasticity of 29 × 10^6 psi. for the reinforcing steel and a 1¼-in. thickness of grout in the connection, a steel stress of between 44,000 to 36,200 psi. could be obtained from the expansion of the grout. However, due to the plastic effect in the concrete during the expansion of the grout and the restraint of the concrete in place, the steel stress would more closely approximate 20,000 to 15,000 psi. Using the more probable value of 15,000 psi. and as an example, a 16 by 16-in. column with six No. 6 bars as reinforcement, compressive stress of 155 psi. would be exerted on the concrete.

This is hardly worth considering as prestressing of the column, but this compressive force is enough to close all voids in the concrete and will give a rigid joint between column and foundation comparable to homogeneously poured concrete. Compressive strength of the grout, according to the same manufacturer's test, on 2 by 2-in. cubes at 28 days using ideal sand grading, was from 10,000 to 11,500 psi. This indicates, by comparison, a strength in excess of the 3,750 psi. at 28 days obtained in a test on a 6 by 12-in. cylinder of 3,500-lb. concrete specified for a typical precast column installed in the Shell plant.

Calculations show that overlapping steel reinforcing bars can be welded continuously for sufficient length to develop full strength and give 100% joint efficiency. This is based on a comparison of reinforcing bar cross-sectional areas versus effects of weld metal areas furnished to satisfy shear requirements. The AISC allowable stress for weld-metal tension and compression is 20,000 psi.—the same as mild steel reinforcing. In shear, the allowable stress is 13,000 psi. for weld metal. Using these allowable stresses, with standard design relationship for bending and shearing, the required area and length of weld can be computed. Table 2 shows examples of minimum weld lengths to develop full strength of steel reinforcing. The bond stresses would be the same in the joint as in the homogeneously poured column and foundation, as the moment at that point would be the same in either case, where the num-



TYPICAL reinforcing-bar welded joint. Fig. 4.



FIELD INSTALLATION showing 4-in. pipe and reinforcing bars in foundation. Fig. 5.

PRECAST COLUMN showing 3-in. pipe with lug ring and reinforcing bars in place. Fig. 6.

ber and size of bars is the same in both cases, except where the bars overlap for welding together in the connection. Fig. 4 shows a typical cross-section of the reinforcing-bar welded joint.

Advantages. This self-aligning and self-supporting connection for precast field joints removes the expensive joint problem and greatly increases the economic advantages of heavy precast work. Through the use of this joint it is expected that precast concrete work will take on new proportions in construction during the next several years.

There are other advantages which recommend the use of precast concrete structures, namely:

1. Considerable field erection time can be saved because the precasting of the structure can be accomplished concurrently with the foundation work and all underground work in the field.
2. There is minimum future maintenance expense, and destruction by fire is essentially eliminated.
3. Materials of construction are readily available.
4. The estimated time for assembly of the precast concrete units to erect the structure shown in Fig. 3 was equivalent to that of erecting a steel structure designed for comparable loading.
5. A cost comparison of a precast concrete structure (see Fig. 3) versus a steel structure of comparable design shows an economy in favor of the precast structure (see Table 3).

A typical installation made at the Shell Chemical Corp. Houston plant is shown in Fig. 3. Typical details of installations are shown in Figs. 5, and 6.

TABLE 1

Cost comparison for two different-type column-base connections. Based on a typical 16 by 16-in. concrete column of each design.

Type—	Labor	Material	Total direct cost
1. New type joint*	$46	$8	$54
2. Base plate with leveling bolts	$98	$41	$139

*Patent pending.

TABLE 3

Structure cost* comparison—	Dollars	Per cent†
Precast concrete frame, erected	11,500	100
Steel frame, erected, sand blasted, and painted	12,500	109
Steel frame, erected, and galvanized	13,500	118
Precast frame, installed, with precast flooring	14,250	100
Steel frame, installed, sand blasted, and painted, with steel floor pl.	16,500	116

*Direct cost, labor and material, exclusive of overhead charges.

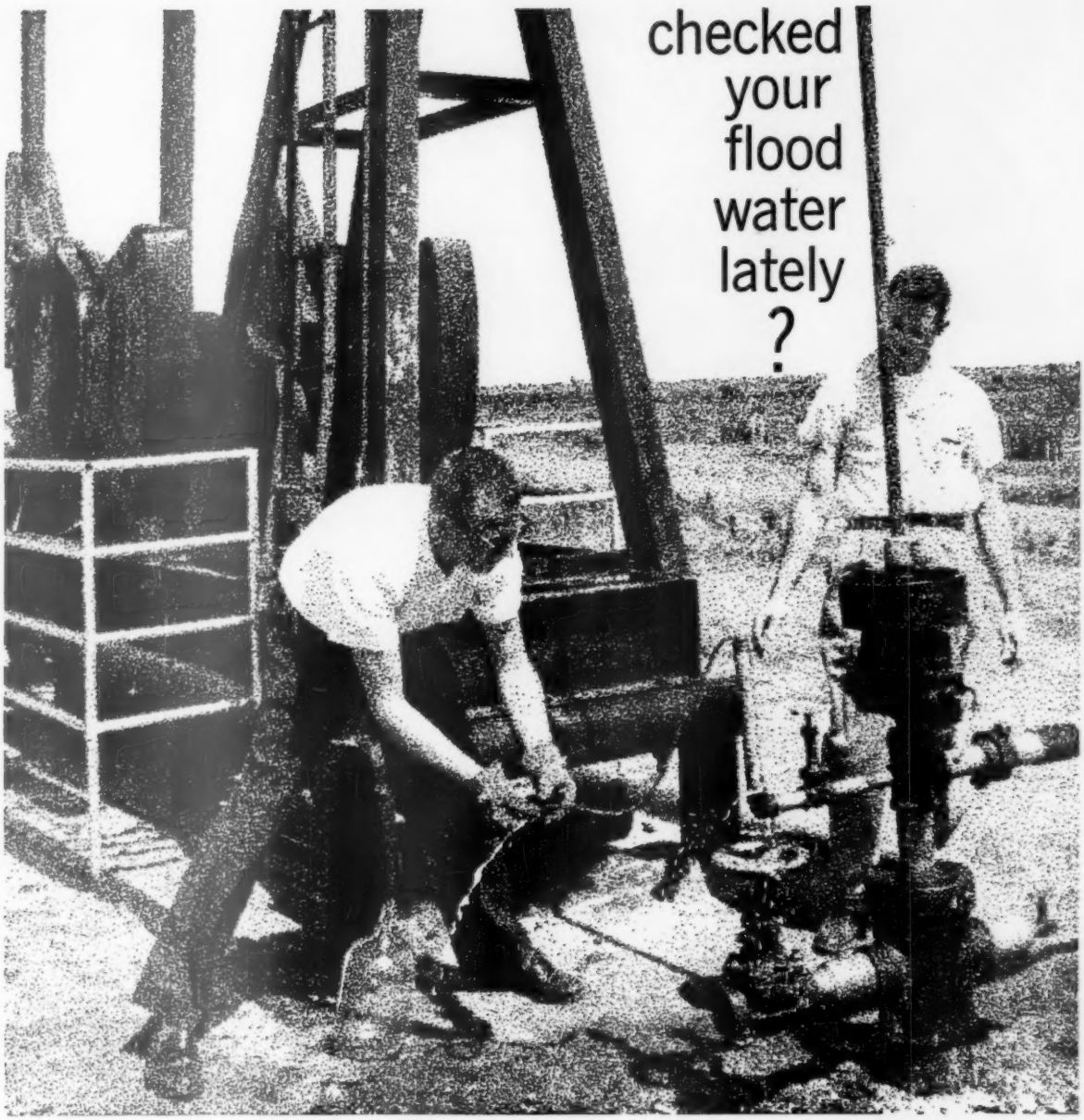
†Per cent relative costs based on total precast structure.

TABLE 2

Comparison of the reinforcing steel area with the effective weld area (throat times weld length) required to develop full bar strength. In Fig. 3, the effective throat is assumed to be one-fourth of the rebar diameter. The length of weld required to furnish this area is computed for bending and shear. Weld metal area required to satisfy bending is omitted from this table. Since shear governs, allowable stresses used for tension, compression, and shear are in accordance with AISC specifications.

Rebar dia. "D" (in.)	Rebar area (sq. in.)	Effective length* weld required for shear (in.)	Effective weld area* required for shear (sq. in.)
½	0.20	1.85	0.23
⅝	0.31	2.29	0.36
¾	0.44	2.71	0.51
⅞	0.60	3.15	0.69
1	0.79	3.64	0.91

*Weld lengths and areas given are required on both sides of reinforcing.



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1 **RG-7J** is designed to drill the weaker or softer segment of hard formations (lime, dolomite and hard sandy shale). Design of the bit assures more action on bottom and faster penetration. Deeper intermesh, wide spacing of the compacts, and interruptions of the lands make it possible for the RG-7J to economically drill formations previously drilled by milled-cutter and R-1 bits.

2 **RG-1J** which replaces the R-1, R-1J and RG-1, is designed to drill the medium range of hard formations which are normally very abrasive. Because of its fortified gage, the performance of the RG-1J in these formations is outstanding.

3 **RG-2BJ** — identified by spearpoints on each of the three cones — has larger diameter compacts and a maximum number of compacts on all rows and on the gage surfaces. It is the most rugged of the R Series bits, and is designed to drill the hardest of the hard abrasive formations, such as quartzite and hard quartzitic sands.

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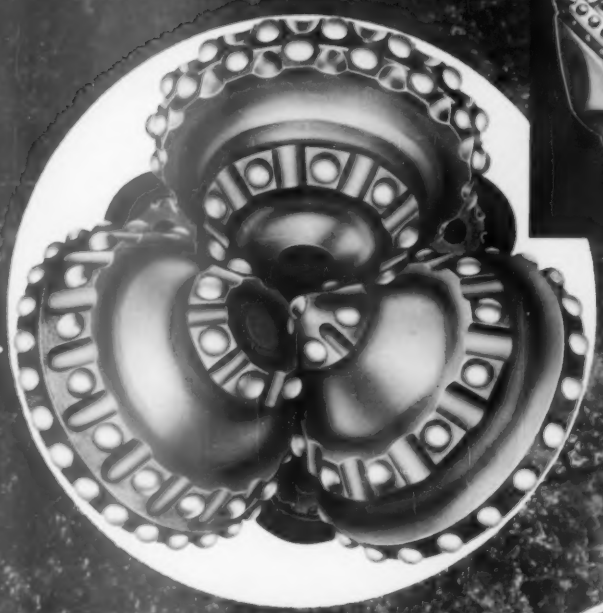
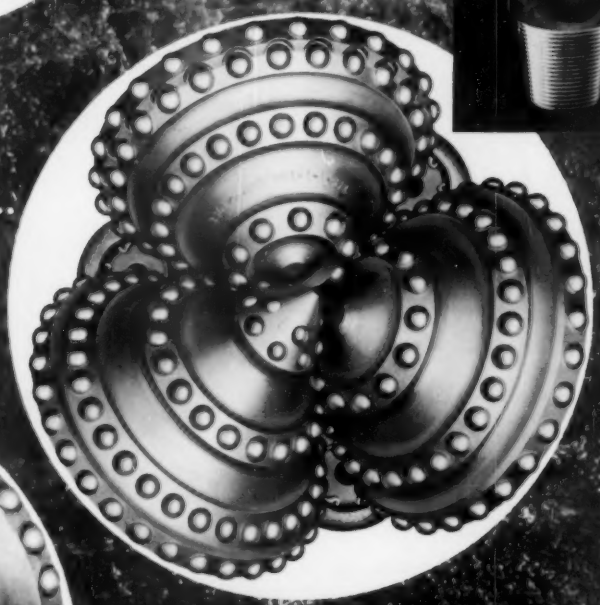
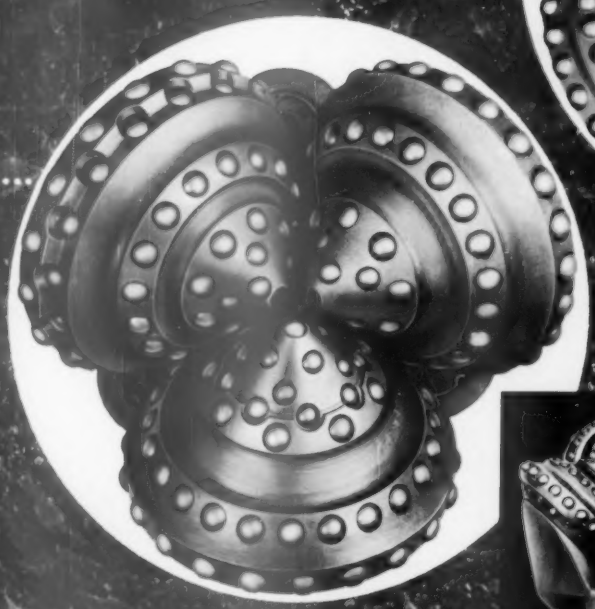


1. **RG-7J** . . . 8¾″

2. **RG-1J** . . . 6″ - 9″





3. **RG-2SJ** . . . 8¾″, 9″, 9⅞″

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Q. At what rate, then, is gasoline taxed?

A. At about 50% of the price, or nearly five times the tax rate on such luxuries as furs and diamonds.

Q. How much have gasoline taxes increased in the last ten years?

A. About *51%*.

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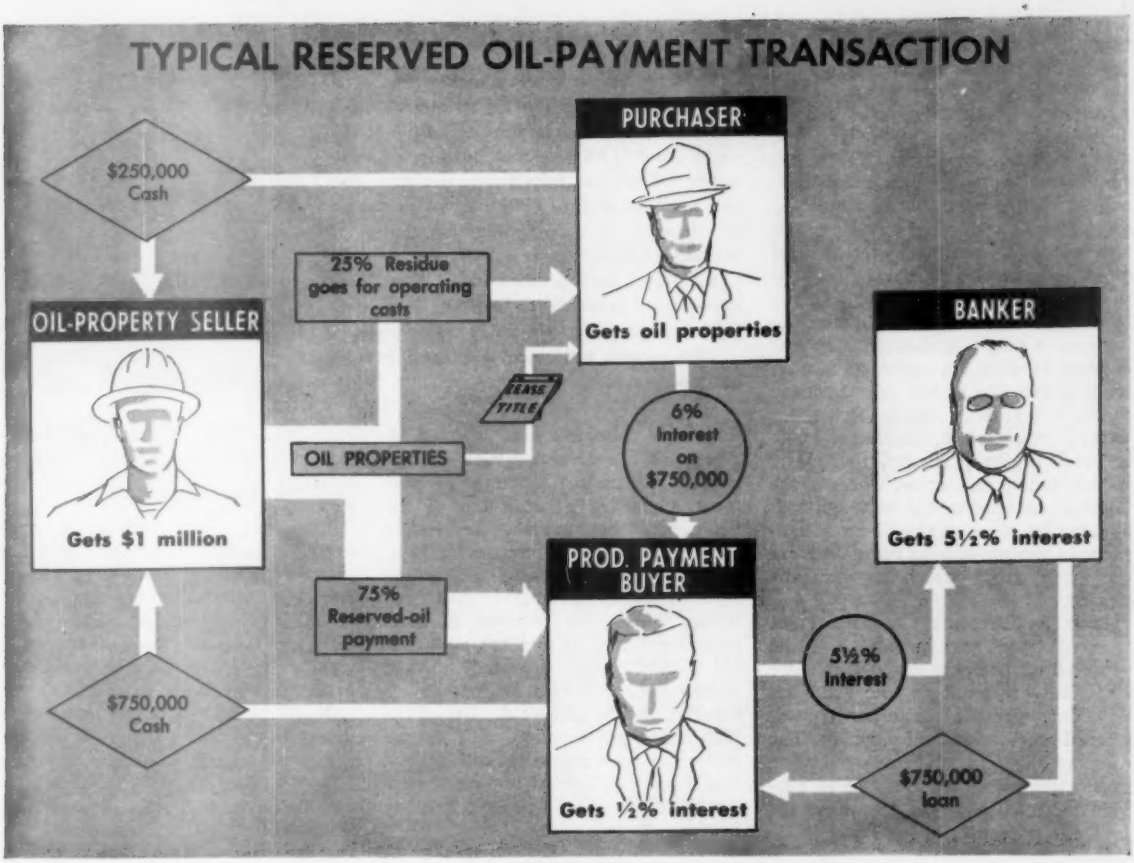


How to finance oil and gas production

• What does it take to get a bank loan on your production? What are the current trends in oil and gas financing? This article answers these questions and discusses some basic banking philosophy.

BY GREG IRETON
Vice President,
First National Bank & Trust Co.,
Oklahoma City

PRODUCTION LOANS date back only about 30 years, at which time companies were forced to use good production practices because of conservation and proration laws. Since then it has been possible for lending institutions to make reliable estimates, forecasts, and projections on which sound loans can be based.

Improved economic conditions following the 1930's increased the demand for oil and gas and more production was needed. The supply eventually caught up with the demand, and this brought about more stringent proration. Lower allowables meant longer payouts on subsequently drilled wells. This, coupled with increased tax rates during World War II, made it impossible for an operator to get a quick return on his investment. Consequently, he was forced to turn more frequently to lending institutions to finance his development programs when his income was no longer adequate to keep pace with these costs.

During this time, petroleum engineering and petroleum geology became more proficient, making it possible to accurately estimate reserves and to predict well performance in such a manner that the risks once associated with oil and gas loans were greatly minimized.

Let's define terms. An oil or gas-production loan is a self-liquidating loan retired out of income that accrues due to production from the mortgaged properties which secure it. These are usually term loans; that is,

they are for longer periods than 1 year.

Another popular manner of obtaining financing is to sell a production payment or as it is often called an oil payment. In the past few years the production payment has really come into its own. A production payment is defined by law as a right to a specified sum of money payable only out of a specified percentage of oil or gas, or the proceeds from the sale of such oil or gas, if, as, and when produced. The main distinction between a direct production loan and a loan involving a production payment is that the former is guaranteed by an individual or corporation whose name is on a note in addition to being secured by the properties mortgaged to the lending institution, whereas, the latter is not guaranteed although it is secured by a mortgage of an assignment of the production payment from the party from which it was purchased.

Actually there are two basic types of production payments. One is the reserved oil payment or, as it is more commonly referred to, the ABC oil payment, whereas the other type is termed a carved-out oil payment. The reserved oil payment is employed when producing properties are sold to provide the maximum tax advantage for both the purchaser and seller.

Here's an example. Let's assume A is the owner of certain oil properties and he wishes to sell them for $1,000,000. Now let us assume B is seeking production and agrees that A's production is worth $1,000,000. However, B knows he cannot afford to pay $1,000,000 outright because of the tax position in which he would be placed. He could not realize a reasonable profit on his investment while operating the properties and paying taxes on the newly acquired income at the same time. Therefore, B must persuade A to take a cash payment of, say $250,000, and reserve an oil payment for the remaining $750,000 to be paid out of 75% of the income derived from the production. They then approach a lending agency which arranges for a third party, C, to purchase the production payment if it is determined there are sufficient reserves to support the payment. The middle-man, C, is necessary because it is illegal for a bank to purchase an oil payment. A then assigns the production payment to C for $750,000 who then gives the bank a mortgage on this assignment to secure a $750,000 loan, the proceeds of which go to A. The bank charges C 5½% interest and C will in turn charge about ½% more than he is paying for his loan.

The author

Greg Ireton has been associated with the oil loan department of the First National Bank and Trust Co. of Oklahoma City for almost 10 years. Most of his work has been in the evaluation of oil and gas properties for loan purposes. In January 1959 he was promoted to the office of vice president in charge of the department. Prior to joining the bank he had about 5 years' experience in West Texas determining reserves for Gulf Oil Corp. geological department. He holds BS degrees in petroleum and geological engineering from University of Oklahoma.

At this point everyone is satisfied. The bank has complied with its customer's request to finance the oil payment, C makes a profit out of the ½% spread between what he charges and what he had to pay for his loan, and A receives his $1,000,000 asking price by taking $250,000 in cash from B and selling the reserved oil payment for $750,000 and can now take his capital gains, provided he had owned the properties longer than 6 months, and be completely out of the picture. B has acquired title to the properties for a minimum cash outlay, and during the period required to retire the oil payment will have virtually no taxes to pay.

Carved-out oil payment. The mechanics of the carved-out oil payment are not as complicated as those of a reserved oil payment. As its name implies, it is a payment carved out of the larger depletable interest. This type of production payment is generally used when a company has had heavy remedial or development expenses on a property which would negate the privilege of taking its depletion allowance on that particular property for that year. In order to take this advantage, the income for that period is estimated and an oil payment for a similar amount is carved out and sold. The bank finances this type of payment in the same manner as it does the reserved oil payment.

No guarantee. The retirement of a production payment cannot be guaranteed in any way. If the tax authorities should detect a guarantee between any of the parties involved, they would treat the transaction as a conventional loan which would then make it necessary for taxes to be paid on the income derived from the purchased properties. This would void any tax advantage to the purchaser of the properties.

Production payments have come into such prominence in the past few years that many of the larger banking institutions claim they constitute as much as 75% of their total petroleum lending portfolio.

In dealing with production payments, in particular, the determination of the optimum percentage of the income that will go toward retiring the payment is of prime importance. Most operators wish to retain only enough income to adequately operate the properties involved. In this way the only taxes required of the new owner would be on that portion of the undedicated income after the operating costs are paid. Years ago, before production payments became so commonplace, some lending institutions did not insist on a sufficiently large percentage of the income to be applied toward retiring the oil payment and later, much to their chagrin, they discovered the supporting reserves were about depleted while the production payment was far from paid out.

Economic Factors

There is one major recurring problem which probably affects the oil industry more than any other and that is the one of oversupply. This has been a periodic dilemma to the industry from its very inception and, currently exists. Anytime others see an area in which big profits are being made there is a rush into this region in order that they, too, may reap some of these profits.

Of course, this is not peculiar to the oil business, but is common to every phase of our economy. Periods of oversupply are brought about when economists, refiners, and other groups overestimate seasonal demands, as well as long-range requirements for one reason or another, or when industry fails to cut back production in time after peak demands have been reached. Much could be done toward eliminating this problem if the various groups comprising the oil industry could be more cooperative and work together more closely.

The present depressed condition in

the petroleum industry has been brought about by a combination of several factors. The one that gets the most attention, of course, is the importation of cheap, foreign crude and refined products. Whenever it is possible to transport crude oil halfway around the world into our East and Gulf Coast ports for more than a dollar a barrel less than we can produce oil in the Mid-Continent area, an unhealthy situation exists. Of course, the oil industry is not alone in this respect as many other phases of our economy are now faced with this same menace.

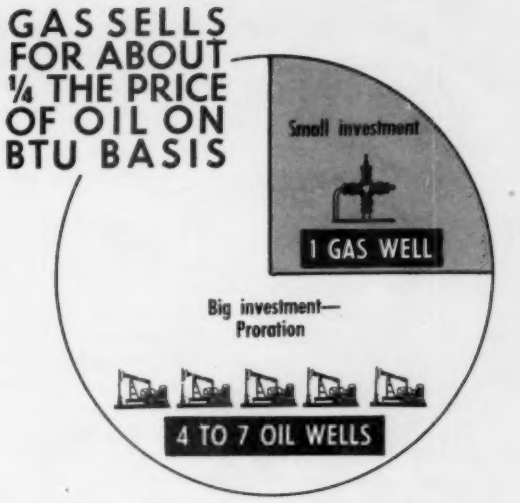
No proration—no help. Added to this problem is the continual overproduction by nonprorated states in this country which do not choose to follow good conservation practices. Every time the prorated states cut back their production in order to alleviate the oversupply condition, the nonregulated states take over that portion of the market. The attitudes of these states are that the older producing states have benefited long enough by dominating the market and they should have their turn now. If this practice continues, it will probably lead to federal proration. Intervention of this kind from the federal Government is undesirable as any oil man who has dealt with the FPC will tell you.

A third factor contributing to the dilemma in the oil business is the displacement of oil markets by natural gas. This trend will continue as long as the natural-gas phase of the petroleum industry expands at a much faster rate than the oil phase.

Today natural gas commands a large part of our total energy market. It has captured from the oil industry a market equivalent to nearly 5,000,000 bbl. per day. At first one might think "so what, natural gas is just as integral a part of the total petroleum industry as is oil." This is quite true, except natural gas does not contribute to our over-all economy nearly so much as does the oil.

In the first place, natural gas sells for only 20 to 25% as much as oil does on a B.t.u. basis. One gas well supplies an energy market that would normally require several oil wells to duplicate based on present proration. And at the same time it produces only about 25% as much revenue. In addition, the states do not receive as much revenue as they would if oil and gas were sold on a commensurate basis, nor are there as many drilling rigs kept active because of the wider spacing employed in the development of gas fields as opposed to oil fields.

A relatively few gas wells can define a large gas field, whereas many more oil wells are required to completely develop an oil field of the same areal extent. This, likewise, adversely affects the oil-field supply companies and service companies, the prosperity of which affects the communities where these businesses are centered. However, the owner of gas production has a good thing in that he usually has good reserves and income to offset his investment, and his operating costs and overhead are only a fraction of what they would be if he had oil production.



Prosperity can mean tight money. Another important facet of the total economic picture that influences petroleum financing is the money market. During times of prosperity, lending agencies do a big business in loans, not only from oil men, but manufacturers, merchants, contractors, etc., and loan volumes begin to rise. At the same time, depositors withdraw their funds in order to buy homes, cars, appliances, and other commodities which causes an over-all decline in deposits, ultimately bringing about a scarcity of money available to loan. It is paradoxical that during boom times money frequently becomes tight because of the trend towards expanding businesses and building inventories, while during times of recession people, in general, become cautious and once again begin saving their money. Bank deposits then begin to rise while loan volume generally declines, and lending agencies again begin competing for customers to find an outlet for their increased deposits.

Commercial banks and insurance companies must compete with savings and loan associations, mutuals, and even the federal Government for deposits these days. With this latter group increasing rates on their dividends and interest on bonds, it has created quite a drain on funds that would normally go to commercial basis.

During the year 1959, for example, of the 10 billion dollars of new money that went into savings accounts, commercial banks got only 25% of this amount. Therefore, tight money is not just an attitude assumed by lending agencies when they think the economy should be slowed, but in reality is a scarcity of money brought about by an optimistic outlook for the future. Of course, when a tight-money situation prevails, it affects the oil man in that he is forced to retard his development programs. In addition, money, like any other commodity, becomes more expensive when scarce. Consequently, interest rates are increased which normally act as a deterrent to the oil man's development and expansion plans.

Despite the somewhat dismal picture at the present, most economists and authorities predict a bright future in the long-range outlook for the petroleum industry. With the population expanding at a tremendous rate, the energy requirements of the future will be great.

Basic Elements of Petroleum Financing

It is a rare oil man who today can replace his depleting reserves out of income alone. Most are forced to borrow periodically to finance their development programs. In dealing with oil producers, there are four basic elements with which lending agencies are most concerned: (1) the credit standing of the producer, (2) the evaluation and appraisal of the collateral that will secure the loan, (3) the operator's ability, and (4) the satisfaction of the legal requirements associated with the loan.

As in the case of any loan, the

"Common practice today is to lend approximately 50% of the discounted present worth of the property."

honesty and integrity of the borrower is the prime consideration; it is essential for the applicant of a loan to have a good credit standing in his community. He must not have a record of delinquent or defaulted payments. A check on the applicant's previous banking experiences and his credit standing with drilling contractors, supply companies, and service companies generally reveals if he is responsible and trustworthy.

What is needed. Most lending agencies require the applicant to furnish a financial statement which generally shows if he has been a successful operator and how he conducts his business. If he does not conduct his affairs in a professional and businesslike manner, then lending institutions have no business lending him large sums of money. It must be determined for what the proceeds of the loan will be used and if the loan will be sufficient to pay off all outstanding indebtedness against the properties that will be mortgaged. This is necessary because the lending agency must be sure that its mortgage will come ahead of any liens or other mortgages.

Once the credit requirements have been satisfied, it is necessary to ascertain if the applicant has enough collateral to secure the loan. The applicant must furnish an evaluation report prepared by a reputable and acceptable consultant covering his oil properties, or provide the lending agency with enough data so its engineering personnel can evaluate the properties. With oil loans becoming such an integral part of the total loan picture, most large banks today employ petroleum engineers to service this type of loan. However, all oil banks must rely upon consultants to some degree.

The operator should be able to furnish well logs, core analysis, bottomhole-pressure surveys, records of gas-oil-ratio tests, water-cut history, drill-stem-test data, initial-well-test data, casing and cementing records, records on remedial work, and production history of each lease involved. Geological information, structure maps, isopachous maps and formation names should be made available. The applicant should furnish legal descriptions of each lease involved, names of the pipeline companies purchasing the oil and gas, the posted price of the crude, gravity of the oil, well spacing, and any other related data. The more complete the data are, the greater the degree of accuracy that can be attained in estimating the reserves.

Role of consultant. The consultant must prepare a satisfactory evaluation report. If he goes to the time and trouble to make an evaluation, his report should be complete and include all the basic data used in its preparation. An evaluation report should include decline curves, core-analysis results, net thickness figures, geological maps, and production and completion data in order to facilitate the bank engineer's work.

The consultant's report should be prepared in such a manner that a nontechnical person can easily find the dollar values and barrel figures but should be complete enough that an engineer can make a quick, independent appraisal. If the report is prepared in any other way, it is incomplete. The best report is one that is concise, to the point and not verbose.

Is the operator experienced? The operator's ability is no small matter in the consideration of an oil and gas loan. With so many amateurs and inexperienced people entering the oil business in the past several years, this problem is of paramount importance. However, an inspection of the applicant's leases does much to reveal how the operator runs his show.

In order to properly evaluate an applicant's properties, individual well tests are required. This is generally done with a consultant or a bank engineer witnessing the operations. Some banks go into this much more thoroughly than others, spending days to obtain current well-test data.

Should the owner of the property not be a professional oil man, he is generally required to have experienced personnel employed directly by him or on retainer, in order to assure proper supervision and maintenance of operations.

The last of the basic elements to be considered in making a loan are the legal requirements. Before a loan can be closed the borrower must furnish a title opinion prepared by an acceptable attorney showing that he owns right, title, and interest to the lease, or leases, involved and that there are no prior liens or mortgages of record. Under no condition will a lending agency permit itself to be placed in a subordinate position in this regard.

Let's close the loan. Once all of these requirements are satisfied, the loan can be closed. To close a loan, such instruments as a note, mortgage (often called a deed of trust), transfer orders, statement of indebtedness, and corporate resolution must be prepared and executed by the corporation officers or in the case of an individual, by that individual. The interest rate, repayment schedule, and the date of maturity are agreed upon by the borrower and lender, and set out in the note.

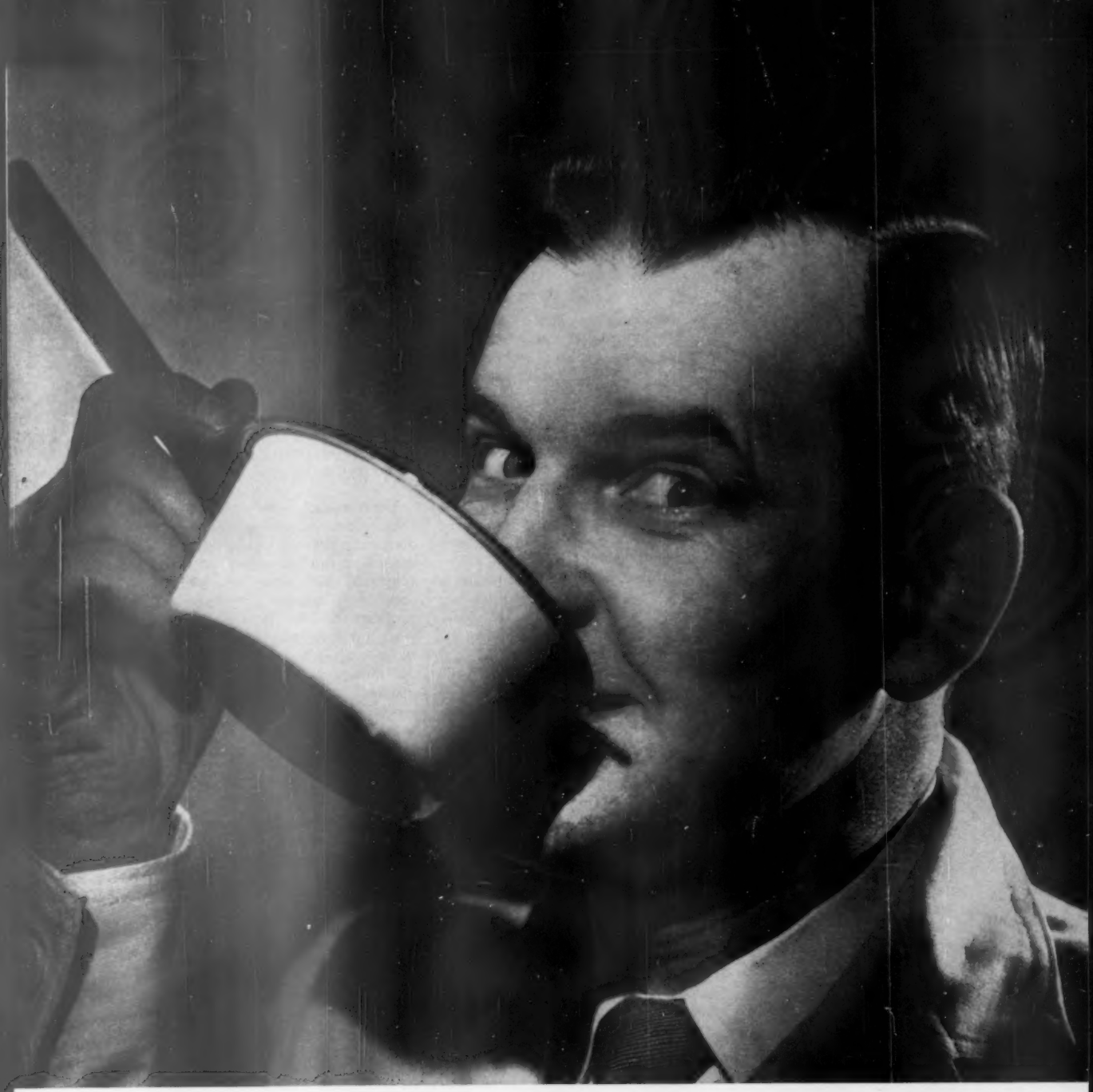
Loan value. In making production loans it is essential to determine the loan value of the producing property. Most loans are based on the discounted present worth.

Common practice today is to lend approximately 50% of the discounted present worth of the property. Other factors, such as the producing life of the property and the payout time of the loan are considered. Most banks and insurance companies require that at least one-half of the reserves be remaining in place after the loan has been paid out. This is a safeguard against the operator retaining too large a percentage of the income while the loan is paying out.

Only presently producing reserves are given consideration in making an oil and gas loan. Salvage value of equipment, reserves behind the pipe, and undrilled locations are only plus values.

Conclusions

Most oil men must continue to rely on lending agencies to finance most of their drilling and development since conditions in the oil industry, which would permit a quicker return on investment, cannot be expected to improve materially in the immediate future. Not until the present oversupply problem is solved can we look for improved conditions; therefore, the producer must economize in every way that is practical. He must be careful not to overextend himself nor get entangled in an endless cycle of continued borrowing, merely to create intangibles to avoid paying taxes. Whenever a producer applies for a loan he should have a definite end result in mind about paying off of the loan. If he is not well organized in this respect, he may find himself enmeshed in a hopeless situation. Therefore, it behooves him to stay abreast of the times and to avail himself of good financial counsel.



HE'S DRINKING A CORROSIVE LIQUID

It's only a drink of water, but it can be highly corrosive—the water source determines to a great extent just how corrosive it is.

Ground water from Utah, for example, is chemically different than ground water from New York . . . different enough to require a pump of different material to handle it most economically. In fact, there's nothing simple about handling water. Salt water, brackish water, hot water—each calls for a different pump material for best performance and longest pump life.

Take another example—distilled water. It's harmless to drink but it can eat the heart out of a pump. Distilled, deionized or demineralized water tends to corrode ordinary metals, and in doing so, the water becomes contaminated. In fact, the purer the water, the more corrosive it is. Worthington uses "Worthite"—a "super stainless" steel—to resist this corrosion and prevent contamination. Worthite will last indefinitely on distilled water service.

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20-15

WORTHINGTON

How digital computer works for Aurora

Uses in two Michigan plants demonstrate its versatility

BY R. W. SHEETS
Aurora Gasoline Co.
Detroit

FOR A LITTLE MORE than a year Aurora Gasoline Co. has been applying a Bendix G-15 digital computer to some of the problems at its 45,000-bbl. per day refinery at Detroit and its 15,000-bbl. per day plant at Muskegon, Mich.

Some of the applications include:

- Material balances.
- Forecasting alkylation, polymerization, and outside butane requirements.
- Analysis of heat-exchanger performance.
- Gasoline blending.

The refining units at Detroit include atmospheric distillation, vacuum reduction, gas-oil Unifining, fluid coking, cat cracking, polymerization, Platforming, extraction, visbreaking, and H_2SO_4 alkylation.

Muskegon units include atmospheric distillation, vacuum reduction, cat cracking, polymerization, and Platforming.

Mid-Continent, Michigan, and Wyoming crudes are processed at both plants in varying amounts.

Equipment

The Bendix G-15 is an internally stored program digital computer using binary arithmetic. A magnetic drum rotating at about 1,800 r.p.m., with 2,160 words of storage in 20 channels, is used for high-speed storage. Input and output are handled by a photoelectric paper-tape reader, a paper-tape punch, or a typewriter. Input and output are buffered. Accessories are available for the computer which allow magnetic tape and cards to be used as auxiliary input and output.

Following are a few of the programs which we have developed or are using from the Bendix program library. They offer a good indication of what can be done with a computer at a small refinery.

Program Experience

Material balance. At the Detroit refinery, there is a common gas-concentration plant which receives both gas and liquid product from a number of units for separation and further processing of light ends. The major contributor to this unit is the cat cracker.

Since the product distribution from the cat cracker is sensitive to a number of variables, and, since a great amount of refinery economics is wrapped up in this unit, it is desirable to determine this basic product distribution.

A material-balance program has been written to do this job. We found, however, that, due to inconsistencies in measurement and analysis, it was impossible to determine accurate data on the component distribution of the cat cracker. Therefore, the material balance has been modified to determine the following:

1. Entire cat cracker gas-concentration, polymerization weight-balance closure.
2. Over-all butane and propane recovery efficiencies.
3. Corrected yield data through the gasoline fraction.

This program is run daily for both the Muskegon and Detroit cat cracking units, and all of the pertinent laboratory and operating data are summarized and printed out in a common statement. Table 1 shows an example of the output data.

This program provides data for plant operating personnel and the technical service department to determine when there are leaking heat exchangers which contribute to nonclosure of the weight balance. Further it helps to point out deficiencies in light-ends recovery and assesses the results of corrective action.

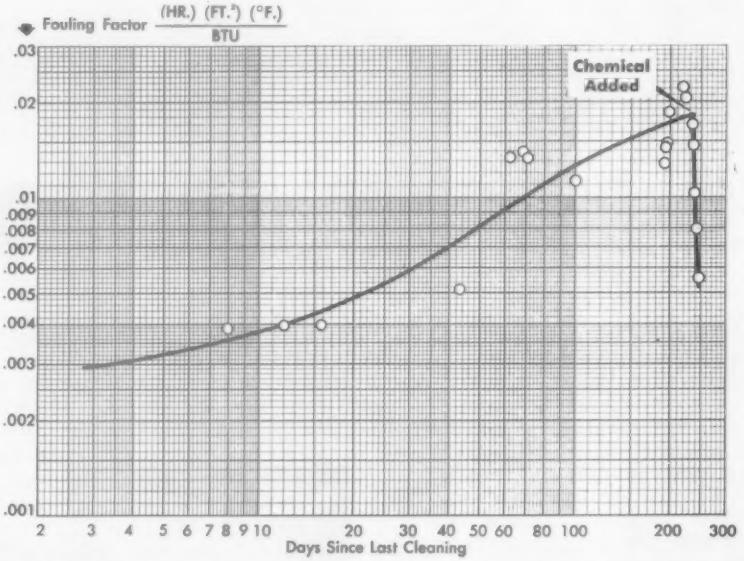
Forecasting. Another program has been written which permits us to balance the light ends in the refinery and determine the amount of polymerization and alkylation required after specifying certain parameters. This program is used in our forecasting work for long and short-term projections, and is based on our product-distribution data on the various plants in the refinery.

This is the information given to the program:

1. Debutanized gasoline-pool volume and vapor pressure.
2. Light-ends volume by component.
3. Desired finished-gasoline-blend vapor pressure.
4. Component recoveries to the unit in gas-concentration process.

Output from the program gives the following data:

1. Polymerization, barrels per day.



HEAT-EXCHANGER performance can be logged and the computer program used to calculate fouling resistance. This information, when plotted versus time, can be used to predict the most economic time for cleaning that exchanger. Fig. 1.

Presented at the WPRA Computer Conference, Tulsa.

TABLE 1—MUSKEGON CAT CRACKER MATERIAL BALANCE

	Date 10-21-59 Bbl.	Wt. % 1.22— Vol. %	Bbl.	Sour 24.00 Vol. %	Lb.	Sweet Wt. %
Cat charge	5,266	100.00	5.229	100.00	1,641,508	100.00
Coke	.....	.....	.....	.....	103,206	6.29
Slurry	758	14.39	598	11.45	199,505	12.16
Heating oil	934	17.73	1,094	20.90	347,547	21.19
Naphtha	2,647	50.26	2,610	49.91	685,914	41.78
Butane and lighter	.....	.....	.....	.....	305,336	18.62
Polymer gasoline	779	14.79	.....	.....	.....	.....
Butane	15	0.28	.....	.....	.....	.....
Propane	197	3.74	.....	.....	.....	.....
Laboratory data—	RON	R.v.p.	Gravity, °API	Sulfur	I.b.p.	E.p.
Cat charge	.....	.....	26.50	.....	408.00	*25.00
Slurry	.....	.....	16.50	.....	453.00	*21.00
Heating oil	.....	.....	26.09	.....	455.00	587.00
Naphtha	96.19	6.69	57.29	.....	100.00	423.91
Operating variables—						
Vol. % conversion	.....	67.65	.....	.....	.....	.....
Coke wt. % hydrogen	.....	11.32	.....	.....	.....	.....
CFR†	.....	1.69	.....	1.40	.....	1.29
Temperatures	900.00	186.00	1,168.00	445.00	.....	.....

*Per cent at 650° F. †Combined feed ratio = (recycle + fresh feed)/(fresh feed). Based on total recycle, slurry recycle only, and heating oil recycle only, respectively.

2. Alkylation, barrels per day.

3. Pool-gasoline volume and vapor pressure.

4. Outside butane required, both iso and normal.

Exchangers. Another program analyzes the performance of heat exchangers. It handles the following heat situations:

Tube side	Shell side
1. Liquid	Liquid
2. Liquid	Condensing
3. Liquid	Condensing-subcooling
4. Liquid	Boiling

The program calculates, among other things, the following information:

1. Shell-and-tube-side heat duties.

2. Log mean temperature difference.

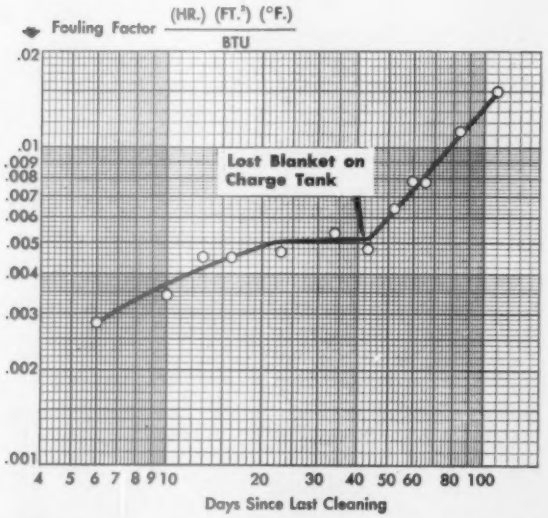
3. Over-all heat-transfer coefficient.

4. Tube-side Reynolds number.

5. Distribution of heat-transfer resistance.

6. Over-all fouling resistance.

With this information, performance of a refinery heat exchanger can be logged by obtaining readings at regular intervals and using the program to perform the analysis. In this fashion, the over-all fouling resistance can be plotted, and the economic time for cleaning the heat exchanger can be predicted; thereby improving the fuel economy of the process.



REGULAR ANALYSIS of heat exchangers with the computer can help to locate equipment failures elsewhere in the refinery. Fig. 2.

TABLE 2—LINEAR PROGRAMING OF DETROIT GASOLINE SITUATION

Problem definition:	
A. Requirements, bbl. per day:	
Gasoline No. 1	1,800
Gasoline No. 2	1,150
Gasoline No. 3	5,500
Gasoline No. 4	(*)
B. Components available, bbl. per day:	
Cat cracked	6,690
Poly	1,080
Combined light	2,900
Pentane	1,000
Butane	Unlimited
Alkylate	Unlimited
Reformer charge	†6,500

*As much as can be blended from the available stocks. †With (1) option of 1,000 bbl. per day to blending; (2) option of extracting: (3) option of low-severity 93-ON or high-severity 96-ON operation.

Other information and evaluations possible from this type of a program include:

1. Determining the effectiveness of an exchanger cleaning job.

2. Determining whether an exchanger needs to be cleaned at all during a turnaround. Some exchangers could foul rapidly from a clean condition to an equilibrium condition from which little fouling occurs over a long period of time. In these cases, it may not be prudent to spend maintenance time and money, since the effectiveness of cleaning lasts only a short time.

3. The use of various inhibitors and even onstream cleaning agents can be evaluated through the performance of the exchanger, as monitored by this heat-exchange program.

4. Comparing the performance of a new exchanger with design values.

Figs. 1 and 2 show some of the results of using this program. Fig. 1 shows how an inhibitor in the hydrocarbon stream improves the performance of the heat exchanger.

Fig. 2 shows the increase in fouling resistance caused by a failure of equipment within the refinery. As a result of this work, the source of the trouble was determined and corrected.

Gasoline blending. After completing some of the basic programs for our computer installation we began investigation and work in the field of linear programing.

In our particular plant with several crudes being processed, a very complicated process scheme, and subject to a wide range of specifications on products, it is impossible to perform enough hand calculations within the allotted time to arrive at certain answers which, in an increasingly competitive situation, becomes absolutely necessary to have.

Linear-programing seemed to offer

a method for coping with this situation. Therefore, we undertook to write a program which would handle our blending operations.

Within 3 months the program was written and in operation. It will handle a problem of 37 restrictions and 37 variables, not including slack variables.

Table 2 shows a typical Detroit gasoline-blending situation as an illustration of the technique. Requirements, available components, prices, and specifications are given for the situation.

Table 3 shows the answers obtained from the linear program. There are four separate blend compositions, vapor pressure, octane, olefin, and TEL values.

Shadow prices, given in Table 4, are listed as penalty prices for forcing a component into a gasoline blend or deviation from the optimum blending situation. The over-all component value for this particular blending situation is given and the specification value is also shown. This is the cost or profit realized from changing the specification one unit.

Here are some conclusions or ideas drawn from a program of this nature:

1. Pentane should be in superpremium instead of premium.
2. Platforming should be practiced nearly 90% of the time instead of Rexforming.
3. Platforming should be at two different octane levels, depending on whether ethyl or housebrand is to be blended.
4. On superpremium and ethyl gasoline, 3 cc. of TEL per gallon should be used instead of 2.8 cc. per gallon.
5. Alkylate is not profitable for us to buy unless the price is below x cents per gallon.
6. Rexformate is worth x cents per gallon.
7. Quality giveaway on Grade 1 and Grade 2 is 14.1 and 13.4 cents per barrel.
8. Up to $500 per day more profit can be realized by blending selectively with separate cat and poly gasoline, instead of combining the rundown streams.

We are using the linear-programing work to show to the plant management the proper components, severities, and directions to blend gasolines on a monthly basis. No attempt has been made to enter into the complex day-to-day blending problems.

This program has been used recently in a process-option crude-selection program. The results have been very encouraging and have provided us with information such as the following:

1. Crude x is worth so much money to the refinery.
2. If the refinery must meet a certain product requirement at a given specification, then profitability is reduced by x dollars.
3. Crude x should be processed in alternative processing route y.

To implement the linear program we have written a matrix-generator program designed to simplify the preparation of blending problems.

The use of the matrix-generator, in conjunction with a component-specification library, makes it possible to write, punch, process, and receive answers to a linear program of a size 37 by 37 in 3 to 4 hours. At this point, several variations can be introduced without lengthening greatly the time required for another final answer.

Future plans include extensive use of the linear-programing technique in the areas mentioned and expansion into refinery simulation.

TABLE 3—COMPUTER RESULTS, COMPOSITION OF BLENDS AND THEIR SPECIFICATIONS

Component	B/D	Vol. %	R.v.p.	RON	% Olefins
A. Gasoline No. 1					
Reformate (high severity)	1,133	62.9	....	....	....
Poly	351	19.5	....	....	....
Extract	132	7.3	....	....	....
Butane	184	10.3	....	....	....
TEL, cc./gal.	3	....	....	....	....
	1,800	100.0	9.5	100	20
B. Gasoline No. 2					
Cat cracked	448	39.0	....	....	....
Poly	93	8.1	....	....	....
Reformate (high severity)	515	44.8	....	....	....
Butane	93	8.1	....	....	....
TEL, cc./gal.	3	....	....	....	....
	1,149	100.0	9.5	99	30
C. Gasoline No. 3					
Raffinate (low severity)	132	2.4	....	....	....
Cat cracked	2,979	54.2	....	....	....
Reformate (low severity)	1,175	21.4	....	....	....
Pentane	1,000	18.2	....	....	....
Butane	209	3.8	....	....	....
TEL, cc./gal.	2.28	....	....	....	....
	5,495	100.0	9.5	95	30
D. Gasoline No. 4					
Poly	634	6.4	....	....	....
Cat cracked	3,262	32.9	....	....	....
Reformate (low severity)	2,405	24.3	....	....	....
Combined light	2,903	29.3	....	....	....
Butane	708	7.1	....	....	....
TEL, cc./gal.	2.84	....	....	....	....
	9,912	100.0	9.5	92.8	....

TABLE 4—RESULTS, PRICES AND VALUES FOR COMPONENTS

1. Penalty for forcing a component into a gasoline blend—deviation from the optimum blending situation.
2. Over-all component value for this blending situation.

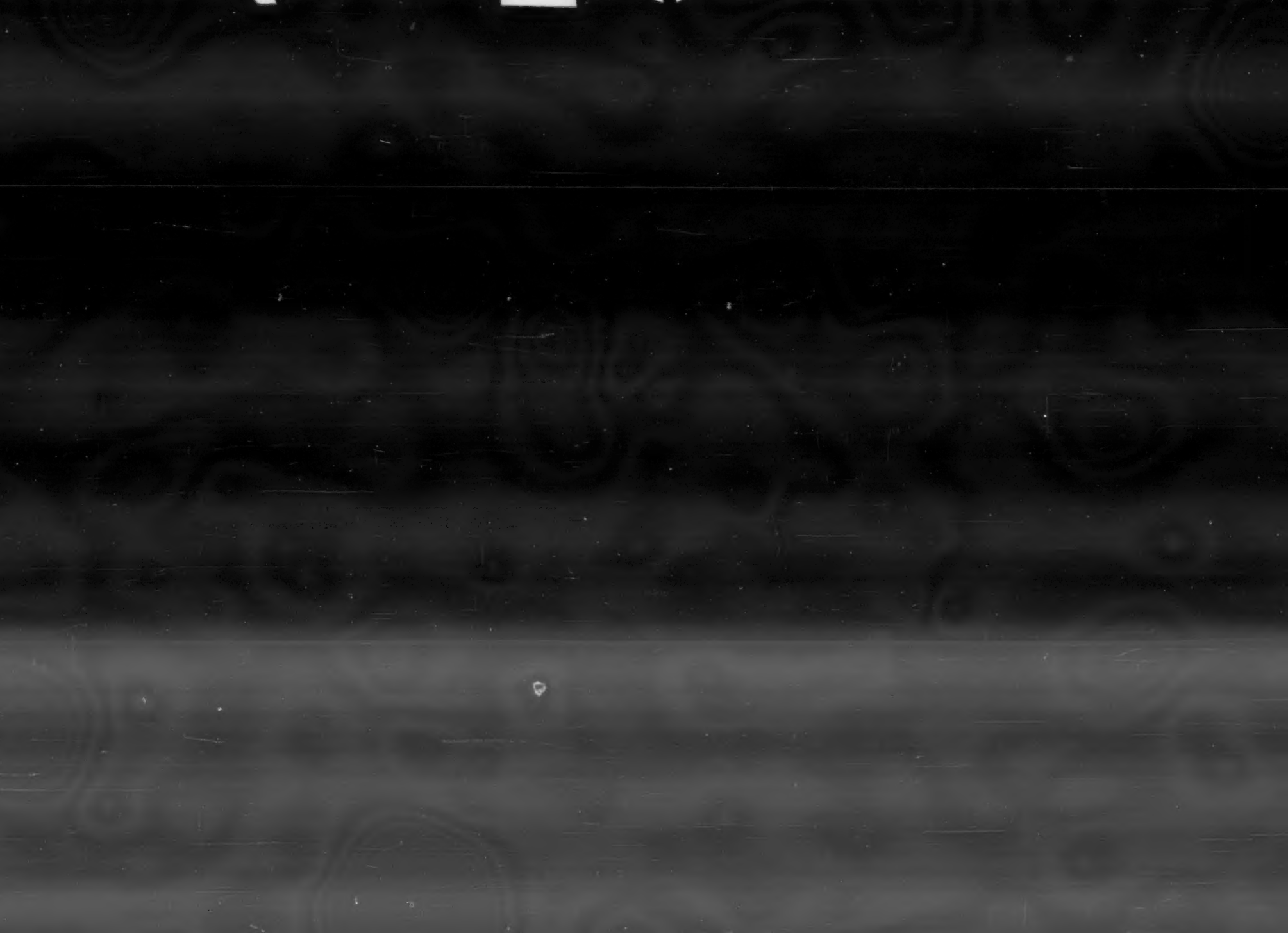
	Penalty, $/bbl.				Over-all component value	
Component—	No. 1 gaso.	No. 2 gaso.	No. 3 gaso.	No. 4 gaso.	$/bbl.	Cents/gal.
Combined light	....	....	0.038	....	4.250	10.12
Pentane	0.410	0.038	....	0.041	4.026	9.58
Cat	0.135	....	....	....	5.344	12.72
Poly	....	....	0.043	....	6.093	14.50
Platformate (low severity)	0.160	0.022	....	....	....	....
Platformate (high severity)	....	....	0.026	0.131	....	....
Extract	....	0.486	....	....	6.871	16.36
Raffinate (from low-sev. plat.)	....	....	....	0.000	4.441	10.57
Raffinate (from high-sev. plat.)	....	....	0.073	0.084	4.509	10.73
Platformer charge	....	....	....	....	4.533	10.79

RESULTS—SPECIFICATION WORTH

Specification Worth—The cost or profit realized from changing the specification one unit.

1. Extra quality of gasoline No. 1 is worth 14.1 cents per bbl. over gasoline No. 2.
2. Extra quality of gasoline No. 3 is worth 13.4 cents per bbl. over gasoline No. 4.

	Specifications			$/bbl. Specification Worth		
Blend—	RON	R.v.p.	% Olefins	RON	R.v.p.	% Olefins
Gasoline No. 1	100	9.5	20	0.110	0.101	0.066
Gasoline No. 2	99	9.5	30	0.067	0.098	0.025
Gasoline No. 3	95	9.5	30	0.060	0.096	0.022
Gasoline No. 4	92.8	9.5	....	0.054	0.093	....



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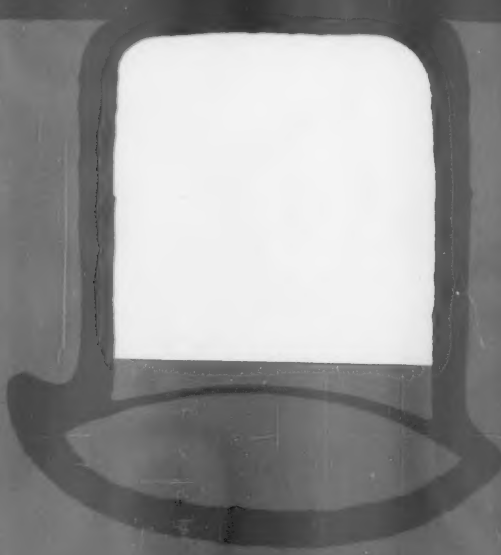

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JEEP-MOUNTED wire-line workover unit at work. Gin pole is shorter than lubricator which supports sheave at top.

THE MINIATURE workover rig you see here is one of the fastest oil-well workover units in the world. Mounted on a light, four-wheel drive jeep, it can move in and set up in no time at all. And once it starts a job, it works just as fast or faster than other wireline units.

Luling Oil & Gas Co. uses this jeep-mounted wire-line unit in three Central Texas fields—Salt Flat, Luling, and Darst Creek. Equipped with a special set of paraffin knives and a heavy sinker bar almost as long as the lubricator, the unit is ideal for cutting paraffin in low-pressure, flowing wells in the area. One man makes up the entire "crew," and he can clean out 7 to 10 wells per day with little trouble.

The unit was designed by Luling's Wallace Shelton, who manages the company's production in the area. Note that the actual mast is a single pole with a strong back made of pipe and hog rod.

The mast is elevated by a winch driven from a power takeoff on the jeep. Once erect, the lubricator—somewhat longer than the pole—is elevated to proper height by a hand windlass shown in the photographs. The "crown-block" sheave is on top of the lubricator.

The "draw works," which spools the wire line out and in is driven by a separate motor mounted in back of the jeep. The most novel feature of the setup is the way of starting the draw-works engine. When an automobile starter—salvaged from a junk yard—is energized, it engages a spline socket as shown. This twirls the engine fast enough to win the admiration of every man who ever had trouble starting a power lawn mower.

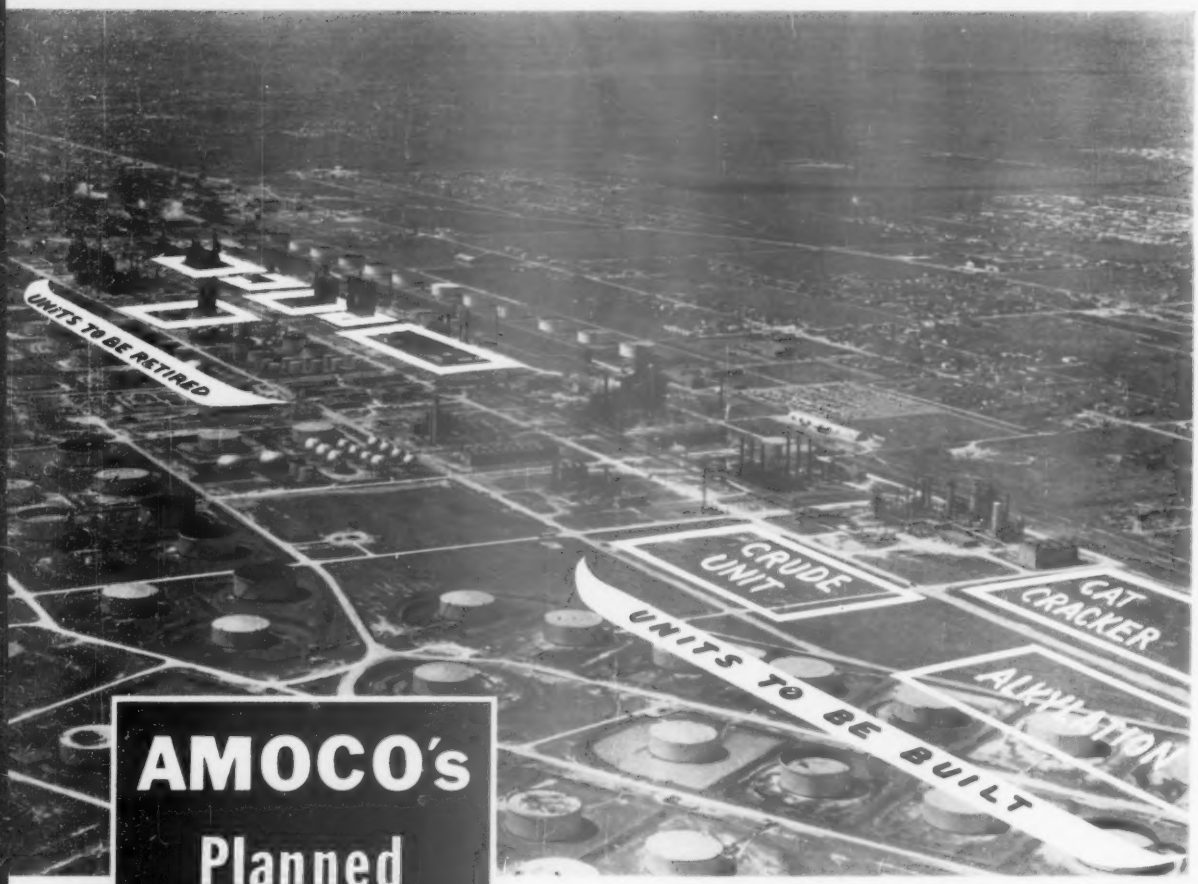
Shown in the photographs is an idler that feeds the wire line to the sheave at the top. A footage counter attached to this shaft keeps the operator informed of the whereabouts of tools in the hole.

Wellheads of these low-pressure flowing wells are designed to speed this job. The pressure gage on the tubing is removed from the tee and the bottom part of a handle-bar union is made up in its place. The lubricator simply makes up with the upper part of the union.

This unit was designed specifically for the job of paraffin removal in the Central Texas area, but it could be adapted to other jobs in other areas with slight modification.

PARAFFIN KNIFE on end of a long sinker bar which fills this unusually long lubricator. Shown here with unit is its designer.

UNIT HAS MOVED OFF, and the one-man crew is lowering the "mast" onto the top of the four-wheel-drive jeep.



AMOCO's Planned Modernization

New construction will not increase capacity very much, but will bring improvement in quality of product and better efficiency

AMERICAN OIL CO. soon will build the world's largest crude unit, plus big new catalytic cracking and alkylation units, at its Texas City, Tex., refinery.

At the same time it will retire from operation three thermal cracking units, a polymerization unit, a treating plant, and a power station.

This huge overhauling operation is outlined in the photograph above.

New units at the east (right) end of the refinery are the 150,000-bbl. per day crude unit, the cat cracking unit with a fresh feed rate of about 47,600 bbl. daily, and the alkylation unit with a 14,600-bbl. per day capacity, largest of its kind.

Toward the west (center and left) end of the refinery are the six units to be retired and eventually scrapped as the new units come on stream. They are: thermal cracking units 1, 2, and 3, power station No. 1, the polymerization unit, and the treating plant.

Amoco says the new construction will not increase capacity at the plant to any great extent but will improve product quality and efficiency.

The crude unit will be larger by 10,000 bbl. daily than a similar unit placed on stream last year by the parent company, Standard Oil Co. (Ind.), at its Whiting refinery. It will be a two-stage pipe still with a fractionation system and will handle all nonasphaltic crude processed at the plant.

Amoco will install waste heat and carbon monoxide boilers in the cat cracker. Gas turbines will handle major loads and permit retirement of the No. 1 power station. Treating plants also can be retired because product treating facilities will be built into the new units.

The No. 1 thermal cracking unit came on stream at Texas City in 1934. The others came later, and improvements have been made—but all are now outmoded.

"By the mid-1950's it had become apparent that technological developments and competitive conditions made it necessary for us to modernize," Amoco President L. W. Moore said last week. "The modernization program is the result of study and planning since that time."

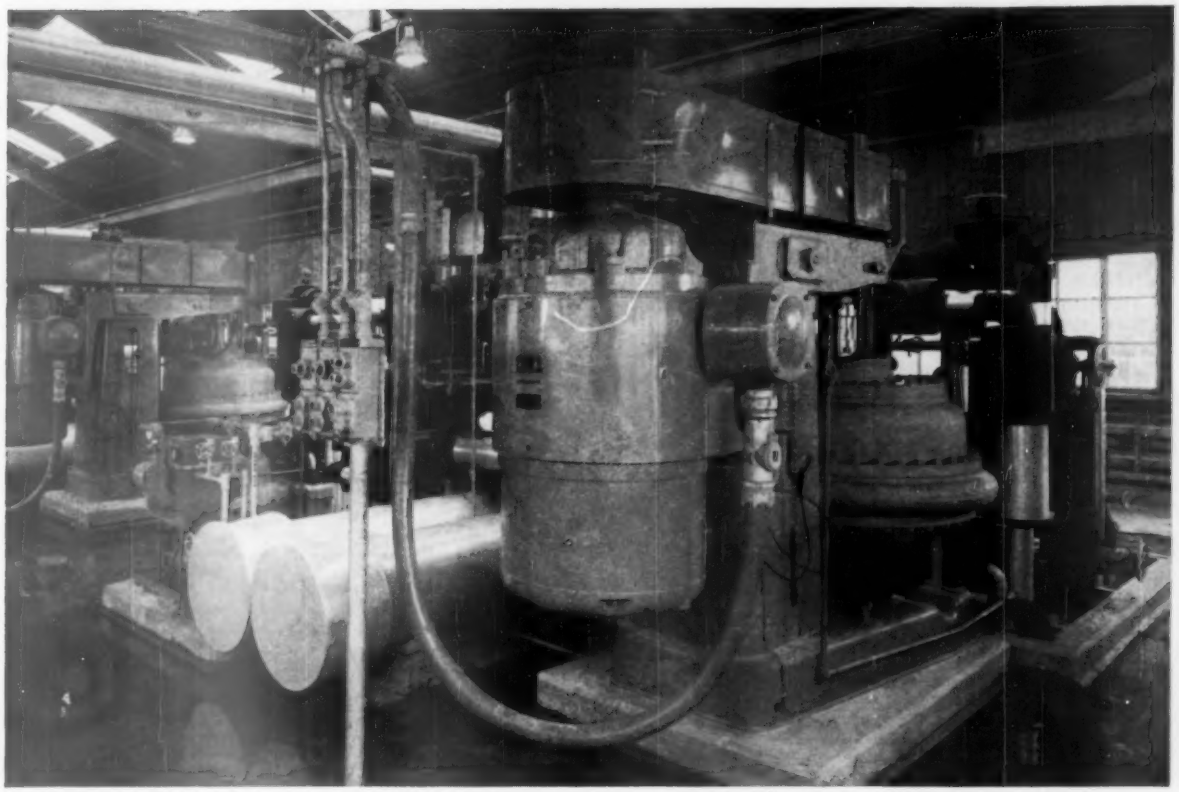
Construction contracts for the program will be awarded shortly.

Plant Manager B. F. Babin said the program will not produce more jobs at the refinery. Amoco this month laid off 72 men and retired 18 others because of automation and lower runs.

at Phillips Chemical Company:

MERCO® PRESSURE CENTRIFUGES

solve catalyst removal in linear polyethylene production



Volume production of MARLEX®, a high quality linear polyethylene made by Phillips Chemical Company under its own process, depends in large measure upon a fast, economic method of separating the catalyst from the polymer.

Key to this vital purification step is the Merco Pressure Centrifuge, which effectively removes foreign particles as small as 0.5 micron by applying forces thousands of times higher than gravity. Each centrifuge delivers an effluent product of less than 8 ppm impurity at capacities of more than 200 gpm.

Merco Pressure Centrifuges are the first and only units of their type continuously effecting a polyethylene-solid catalyst removal on a high production commercial basis. At Phillips—and in several other plants licensed under the Phillips process—these units are operating around the clock 7 days a week. Many installations schedule only 2 Merco shutdowns per year for maintenance and examination.

Merco Continuous Pressure Centrifuges are revolutionizing many operations in processing industries where high speed, controlled separation is a key to quantity production. Laboratory or commercial scale units are available for trial or demonstration on your products. For information, write Dorr-Oliver Incorporated, Stamford, Connecticut.

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WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT

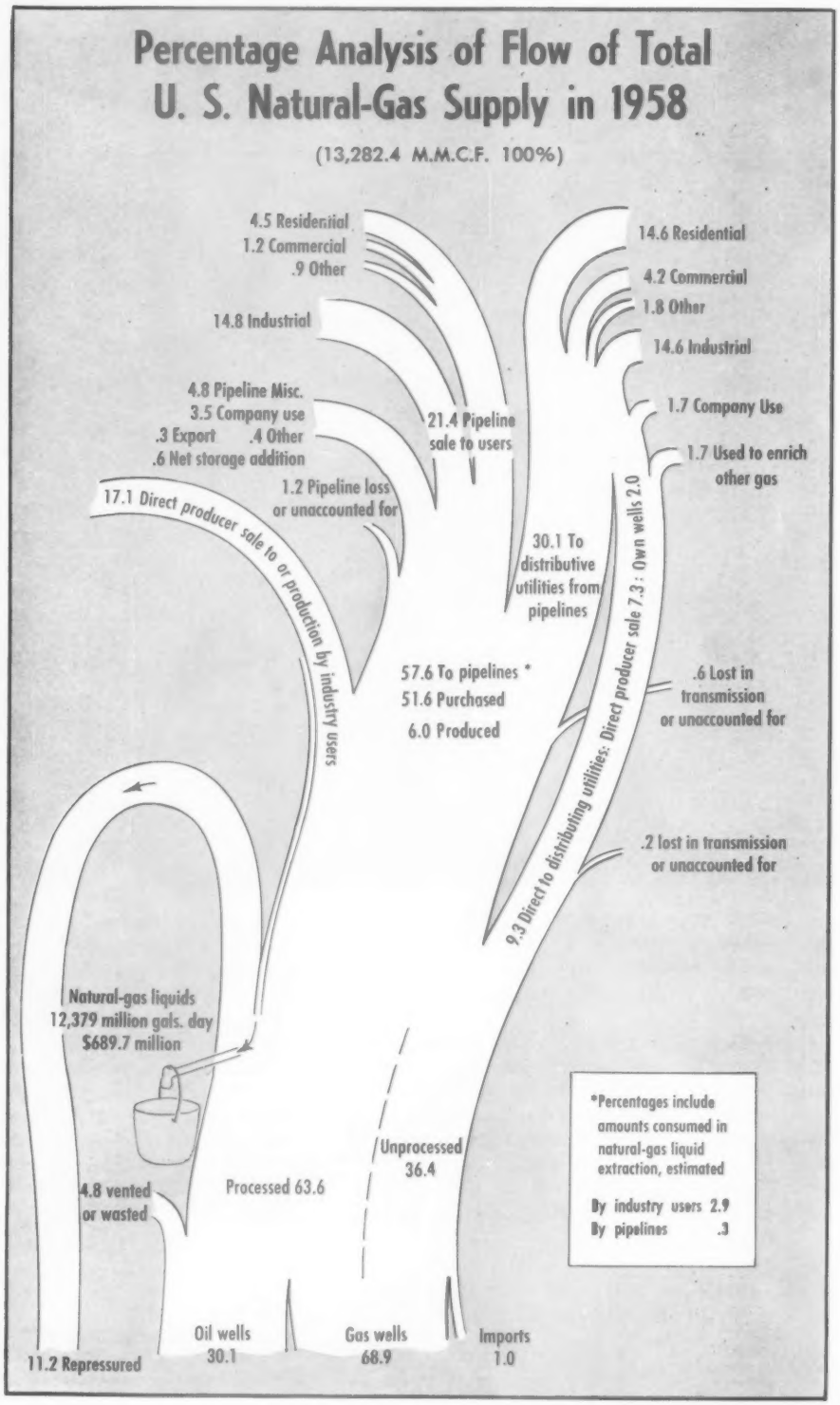
How natural gas moved in 1958

BY ISRAEL PUTNAM
Fuel Economist, Washington, D. C.

A CHART showing the general movement of natural gas through various channels of regulation into its final use during 1958 has been prepared from data gathered and published by the Federal Power Commission, the U. S. Bureau of Mines, and the American Gas Association.

Manipulation of the data to derive a chart giving a reasonably simple presentation of the gas industry necessarily runs the risk of including minor errors. One of these possible errors is to include in the "pipeline" flow only the quantity over which the Federal Power Commission asserts jurisdiction. This, in terms of actual gas handling, considerable intrastate pipeline flow is included in the category "sales direct to, or production by distributing utilities."

In terms of regulation though, this is no error, for both distributing utilities and intrastate pipelines are subject to state, rather than federal regulation. For all such interpretations, and for any mistakes made by the author of the chart in handling the data, the originating agencies should not be held responsible.


Percentage Analysis of Flow of Total U. S. Natural-Gas Supply in 1958
(13,282.4 M.M.C.F. 100%)
4.5 Residential
1.2 Commercial
.9 Other
14.8 Industrial
4.8 Pipeline Misc.
3.5 Company use
.3 Export .4 Other
.6 Net storage addition
1.2 Pipeline loss or unaccounted for
17.1 Direct producer sale to or production by industry users
21.4 Pipeline sale to users
14.6 Residential
4.2 Commercial
1.8 Other
14.6 Industrial
1.7 Company Use
1.7 Used to enrich other gas
30.1 To distributive utilities from pipelines
57.6 To pipelines *
51.6 Purchased
6.0 Produced
9.3 Direct to distributing utilities: Direct producer sale 7.3 : Own wells 2.0
.6 Lost in transmission or unaccounted for
.2 lost in transmission or unaccounted for
Natural-gas liquids
12,379 million gals. day
$689.7 million
4.8 vented or wasted
Processed 63.6
Unprocessed 36.4
11.2 Repressured
Oil wells 30.1
Gas wells 68.9
Imports 1.0
*Percentages include amounts consumed in natural-gas liquid extraction, estimated
By industry users 2.9
By pipelines .3

HOW NATURAL GAS MOVED IN 1958

TABLE 1—AN ANALYSIS OF CHANNELS OF NATURAL-GAS FLOW IN 1958

	M.M.c.f.	Per cent	Source
Domestic production:			
From oil wells	3,992.6	30.1	A
From gas wells	9,154.0	68.9	A
Total domestic production	13,146.6	99.0	
Imports	135.8	1.0	A
Total supply	13,282.4	100.0	
Processed	8,452.5	63.6	B
Unprocessed	4,829.9	36.4	B
Total supply	13,282.4	100.0	
Disposition of supply:			
Vented and wasted	633.4	4.8	A
Used for repressuring	1,483.0	11.2	A
Consumed, exported, stored, and lost in transmission	11,166.0	84.0	
Utility purchase and production:			
Pipeline:			
Purchase	6,857.0	51.6	E
Production	799.7	6.0	D
Total pipeline	7,656.7	57.6	
Local utility:			
Purchase	972.3	7.3	
Production	†262.5	2.0	C
Total local utility	1,234.8	9.3	
Total utility purchase and prod.	*†8,891.5	66.9	C
Nonutility use, from direct purchase and own production	‡2,274.5	17.1	

*Millions of therms figure, converted at 1,035 B.t.u. per cu. ft.

†AGA totals ajdtuesd as follows: plus 38.7, for exports (not provided for) and minus 16.3 to adjust AGA net storage down to later USBM figure.

‡By subtraction, 123.3 of "consumption" which did not actually occur, but should be attributed to one or more of the waste factors, is included in this figure. See Table 5.

TABLE 2—UTILITY PURCHASE AND PRODUCTION SUMMARY OF DISPOSITION

	M.M.c.f.	Per cent	Source
Pipeline:			
Sales to distributive utilities, for final resale or use	3,993.7	30.1	
Sales for export	38.7	0.3	A
Sales direct to final users	2,844.8	21.4	D
Company use	463.3	3.5	Table 3
Other deliveries, net (i.e., for compression)	67.2	0.4	C
Net storage addition	*83.1	0.6	A
Lost in transmission or unaccounted for	165.9	1.2	Table 4
Total pipeline	7,656.7	57.6	Table 1
Local utility, direct purchase and production:			
Sales direct to final users, company use, and new storage addition†	1,207.6	9.1	
Lost in transmission and unaccounted for	27.2	0.2	
Total local utility, direct purchase and production	1,234.8	9.3	Table 1
Total detail of utility purchase and production	8,891.5	66.9	Table 1

*Assumes all net storage is pipeline. USBM figure is used here as being later and perhaps more reliable than earlier AGA figure.

†Not separable for this segment of distributive utilities. Total derived by subtraction of unaccounted for from total supply.

TABLE 3—UTILITY PURCHASE AND PRODUCTION DETAIL OF DISPOSITION

	M.M.c.f.	Per cent	Source
Pipeline (excluding sale for U. S. resale):			
Sales to final users:			
Residential	604.0	4.5	D
Commercial	155.6	1.2	D
Industrial	1,964.6	14.8	D
Other	120.7	0.9	D
Total sales to final users	2,844.8	21.4	D
Sale for export	38.7	0.3	A
Company use	*463.3	3.5	U
Other deliveries, net (i.e., for compression)	67.2	0.4	C
Net storage addition	†83.1	0.6	A
Lost in transmission or unaccounted for	165.9	1.2	Table 4
Total sales to final users	3,663.0	27.6	
All distributive utilities:			
Sales to final users as natural gas	4,672.8	35.2	C
Gas used to make or enrich other gas‡	*210.0	1.6	C
Company use	*228.4	1.7	C
Net storage addition	0	0	
Lost in transmission or unaccounted for	117.3	0.8	Table 4
Total all distributive utilities	5,228.5	39.3	
Total pipeline (excluding sale of U. S. resale)	8,891.5	66.9	Table 1
All utilities (excluding sales for resale):			
Sales to final users as natural gas	7,517.6	....	C
Sales to form mfd., mixed or enriched gas	210.0	....	C
Sales in export	38.7	....	A
Company use	691.7	....	C
Other deliveries, net	67.2	....	C
Storage, net addition	83.1	....	A
Unaccounted for or lost in transmission	283.2	....	C
Total all utilities (excluding sales for resale)	8,891.5	....	

*Millions of therms figure, converted at 1,035 B.t.u. per cu. ft.

†Assumes all net storage is pipeline. USBM figure is used here as being later and perhaps more reliable than earlier AGA figure.

‡AGA figure is used instead of USBM for "residential" and "commercial" end use of natural gas.

TABLE 4—COMPUTATIONS "UNACCOUNTED FOR"

Compute allocable proportion as though there were no unaccounted for	*283.2	C
(a) Pipeline total purchases and production	7,656.7	Table 2
Less pipeline sales for export, direct to users, company use, other deliveries, net storage	3,497.1	Table 2
(b) Balance for sales to pipeline utility customers	4,159.6	
(c) Local utility direct gas supply, not using pipeline	1,234.8	Table 1
(d) Total quantities of gas handled, including double handling (a + b + c)	13,051.1	

Proportions: (a) 58.6% (b) 31.8%, (c) 9.6% = 100.0%

(e) Unaccounted for allocated: (a) 165.9, (b) 90.1, (c) 27.2 = 283.2

*Millions of therms figure, converted at 1,035 B.t.u. per cu. ft.

The foregoing assumes that the leakage and unaccounted for of gas sent through the long (but tight) lines of transmission companies will about equal that for similar quantities of gas locally distributed through fewer miles of lower pressure (but leakier) mains and meters.

(Table 5 on next page)

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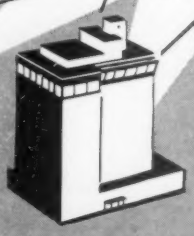

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HOW NATURAL GAS MOVED IN 1958

TABLE 5—SUMMARY OF DATA USED IN CHART, RECONCILING FROM USBM AND AGA

(USBM MMS 2972)

Domestic production	13,146.6
Repressured	1,483.0
Vented and wasted	633.4
Total repressured and vented and wasted	2,116.4
Marketed domestic production	11,030.2
Imports	135.8
Total domestic supply marketed	11,166.0
Transmission loss	283.6
Stored	83.1
Total transmission loss and stored	366.7
Total "consumption"	10,799.3
Domestic consumption:	
Residential	*2,714.3
Commercial	†871.8
Field use	1,604.1
Carbon black	211.0
Refinery	681.9
Other industry	4,677.6
Total domestic consumption	10,760.7
Exports	38.7
Total "consumption"	10,799.4

(AGA Gas Facts, 1959)

*Less residential and commercial sales of manufactured, mixed, etc., gases of low B.t.u., using natural	333.3
†Add sales of natural gas to such reforming or mixing companies	210.0
Total adjusted "consumption"	10,676.1
Indicated additional gas unaccounted for by USBM consumption	123.3

	Source A	Source C
Domestic supply	11,166.0	
Less exports	38.7	
	11,127.3	
Storage	83.1	99.4
Transmission loss and unaccounted for	283.6	283.2
Residential	2,714.3	2,543.0
Commercial	871.8	709.8
Industrial	7,174.6	3,904.9
Other		359.9
Gas manufacturer		210.0
Company use		691.7
"Other deliveries"		‡67.2
Deduct conceptual difference due to gas manufacture use of natural	123.3	
Total domestic supply	11,004.1	8,969.1
Nonutility industrial		§2,135.0

‡Presumably to industry, of gas carried for hire, or compressed, or paid as royalty in kind, etc.

§Compares with 2,274.5, including the 123.3, in Table 1.

SOURCES

A—USBM, Mineral Market Report MMS No. 2972.
B—USBM, Minerals Yearbook, Natural Gas Liquids chapter preprint.
C—AGA Gas Facts, 1959.
D—FPC Statistics of Natural Gas Utilities, 1958.
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At Cities Service Oil Company's Rahway, N. J. refinery

Bitumastic Coatings outlast costly materials on tough, tide-zone piling protection

The Cities Service refinery's docking area is located on the Arthur Kill, a salt water channel with a high content of industrial wastes and debris that presents a tough corrosion problem. That's why special attention was given to the protection of sheet steel piling at the wet-dry zone.

Two types of coating systems were tried, both over sandblasted steel; one, a new type of coating using "exotic" materials, and the other, a combination of two Koppers coatings: Bitumastic® No. 50 and Bituplastic® No. 28.

Within six months, the more expensive coating was badly deteriorated, and had to be removed, while the Bitumastic coating system was still in excellent shape—and is now protecting *all* the piling. The combination of heavy-duty undercoating given by thick, tough Bitumastic No. 50 and the sunlight and water-resistance of Bituplastic No. 28 over this base was the happy answer to the specific conditions.

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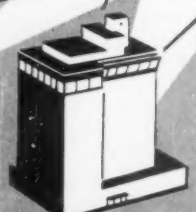

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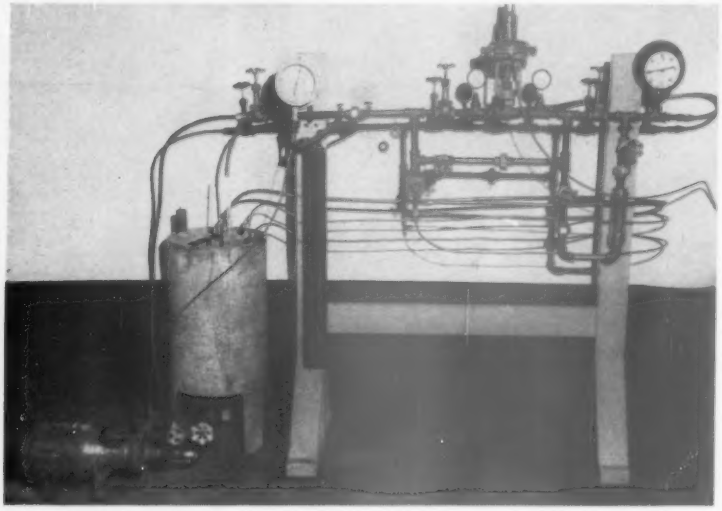
These demonstrations show fluid-flow principles

Does flow rate depend upon available pressure?



DEMONSTRATION 4

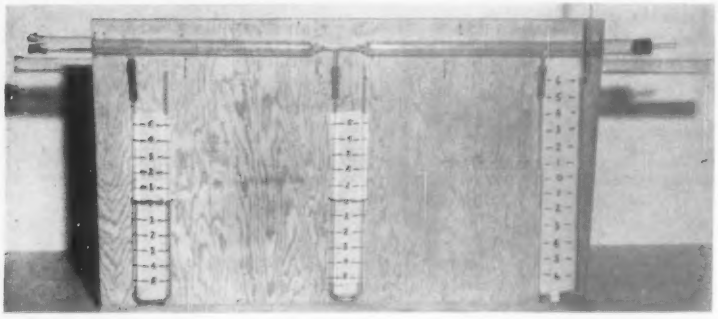
There must be a pressure drop in the system to cause flow.

Decreasing the pressure drop across a valve increases the rate of flow.

An increased rate of flow results in an increase pressure drop across an orifice.

Equipment includes piping system with reservoir, pump, orifice, manometer, control valve, pressure gages, and rotameter.

How does energy conversion occur in fluid system?



DEMONSTRATION 5

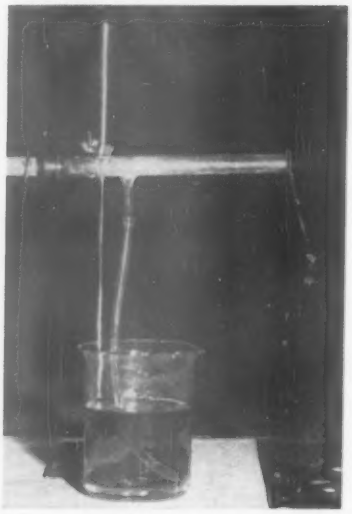
The basic conversion is pressure to velocity and heat.

Bernoulli's principle states that, with a fluid in motion, pressure decreases whenever its velocity increases.

Apparatus shows principle of Venturi meter.

This material taken from process-training-program manual, Bayway, N. J., refinery of Esso Standard Oil Co.

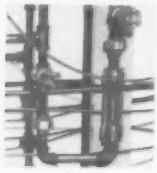
What is result of velocity on pressure?



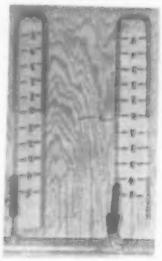
DEMONSTRATION 6

Conversion of pressure to velocity energy in siphon results in pressure less than atmospheric at tip of nozzle.

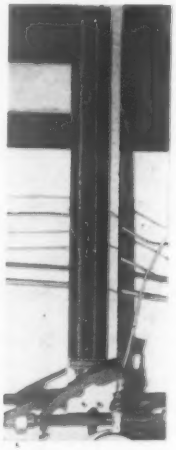
How are flow rates measured?



(a)



(c)



(b)

DEMONSTRATION 7

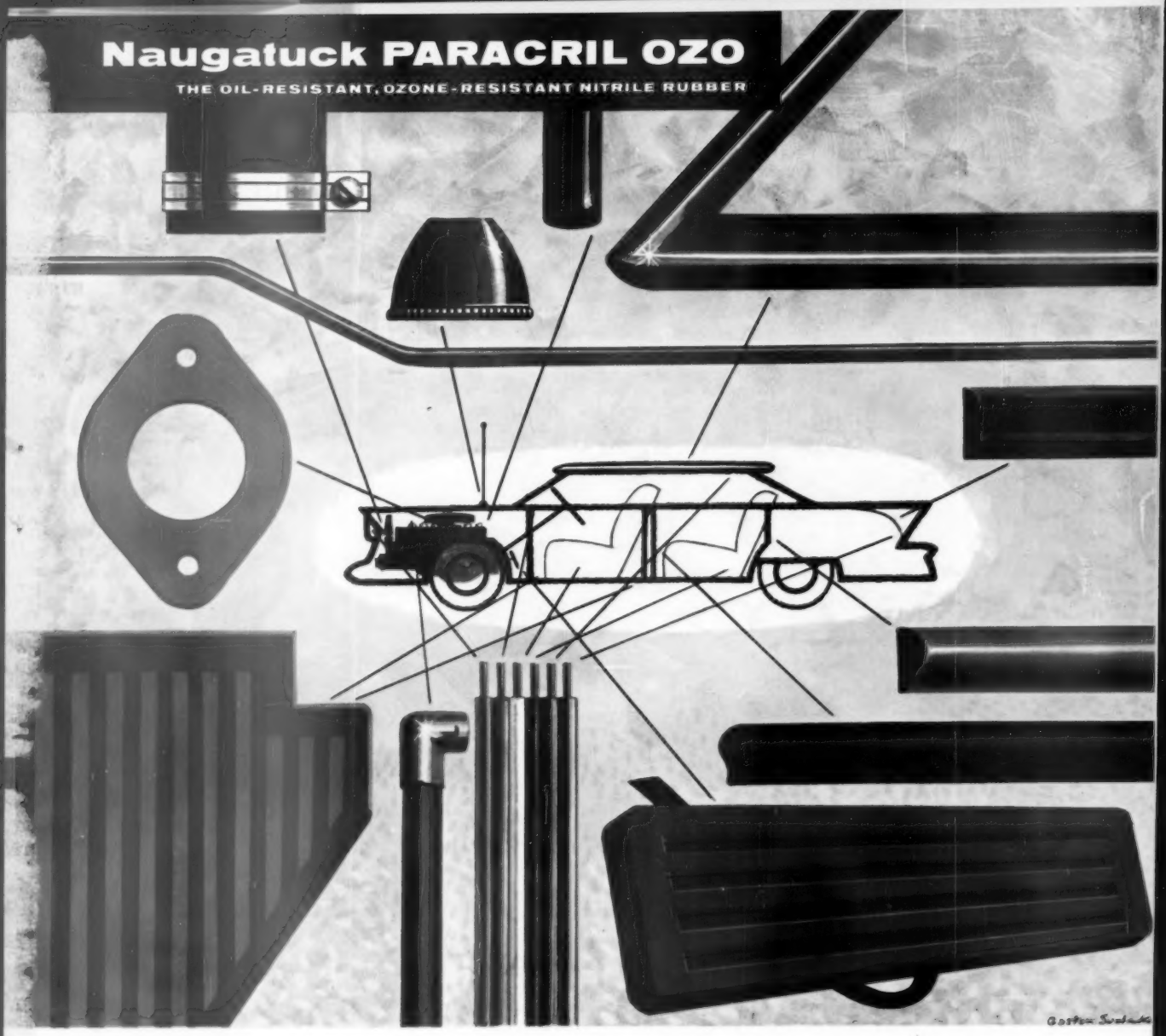
(a) Rotameter. Rate of flow is based upon velocity. As float is lifted, area around the float increases. Pressure drop across the rotameter is constant.

(b) Orifice plate. Pressure drop is related to rate of flow.

(c) Pilot tube. Difference in static pressure and velocity (pressure) is related to rate of flow. Probe must be located properly to measure average velocity.

Naugatuck PARACRIL OZO

THE OIL-RESISTANT, OZONE-RESISTANT NITRILE RUBBER



Great new advance in automotive rubber

Here is a new rubber that's unmatched for oil, weather, and abrasion resistance. It's new PARACRIL® OZO, the finest achievement yet in the nitrile rubber field. PARACRIL OZO's properties are tailor made for many modern automotive parts—for everything from weather stripping to oil seals and hose. PARACRIL OZO gives you a whole series of important advantages, including:

- significantly superior ozone resistance
- excellent fuel and oil resistance
- several times greater abrasion resistance
- permanent retention of bright colors for exterior styling and easily traceable wiring and other interior parts

Look into PARACRIL OZO. Discover for yourself its new design possibilities...its unlimited color...its high quality. Contact your nearest Naugatuck representative at the address below.

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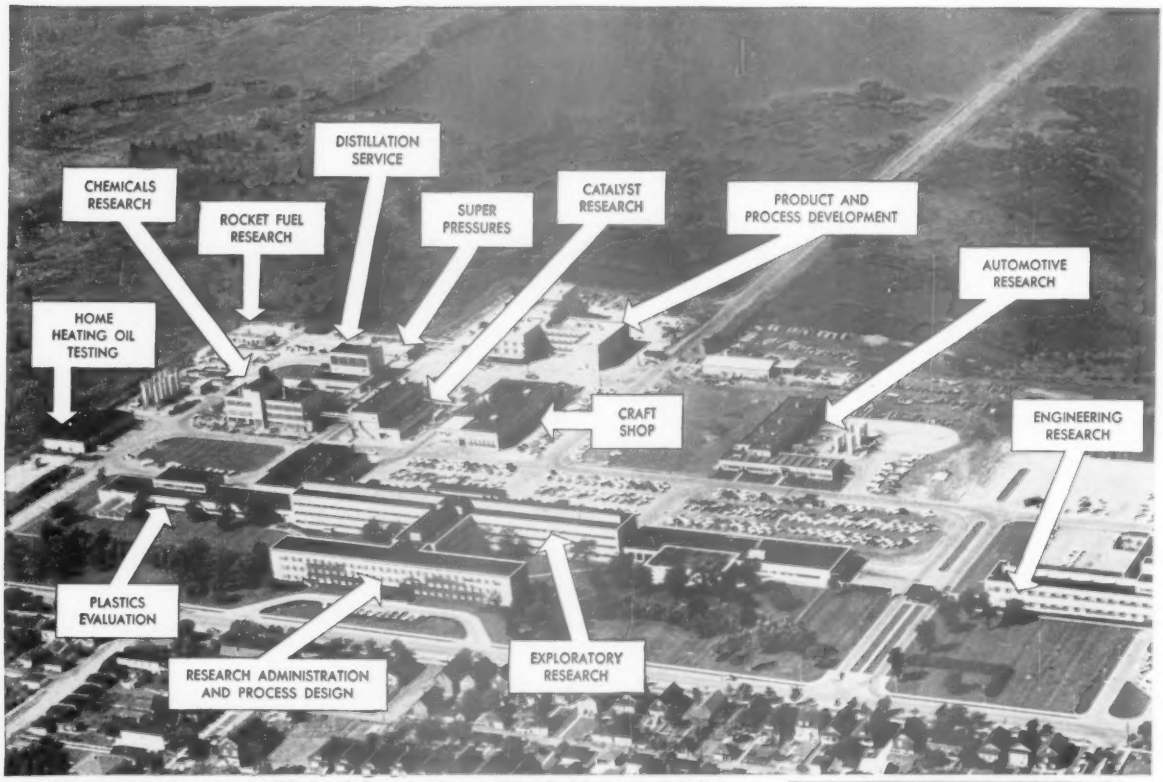


THIS HUGE RESEARCH CENTER at Whiting, Indiana, is only part of Standard Oil's research facilities. Since Standard's first research laboratory opened 69 years ago, Standard scientists have made many contributions to petroleum progress—contributions that have made driving more economical.

Where the fuels of the future are born!

From time to time, we are asked if gasoline and oil today really are better than they were five or ten years ago. People can't see the difference, smell it, or feel it.

The answer is an emphatic yes. And this aerial view of Standard Oil's research center at Whiting, Indiana, is graphic evidence of the extensive research work that goes on behind the scenes before Standard Oil gasoline or oil goes into a car.

Intensive and continuous research has produced spectacular improvements that mean great savings to consumers. For example, in 1930 one gallon of gasoline moved one ton of automobile 25 miles at 40 mph. Today one gallon—after the scientists have finished with it—moves one ton *43 miles* at the same speed!

Today's new cars would have difficulty operating on the type of gasoline that was sold just five years ago! And right now motor fuels are being developed for cars that will not be a reality until about 1965.

Rocket fuels, too, are being developed. In fact, Standard's development of clean-burning, highly-reliable solid fuels has been a real contribution to America's missile program.

Yes, it's true that the difference in gasoline can't be seen, smelled or felt. But thousands of scientists and technicians are working in these laboratories every day to make Standard gasolines and oil better than ever, working to conserve the country's oil for future generations...to make oil *more useful to more people than ever before!*

What makes a company a good citizen?

Looking ahead, preparing for the future is one measure of good citizenship. If a company is heedless of the future, it endangers the economic well-being of its employees, its stockholders and the communities in which it lives and works. That is why research has played a major role at Standard for 69 years.

FINDING MORE OIL and finding it faster is the main job of this gigantic research center of Pan American Petroleum Corporation, a Standard affiliate. It is in Tulsa, Oklahoma, and is famous for inventions that have added billions of barrels to America's oil reserves.

STANDARD OIL COMPANY
(INDIANA)

STANDARD

THE SIGN OF PROGRESS...
THROUGH RESEARCH

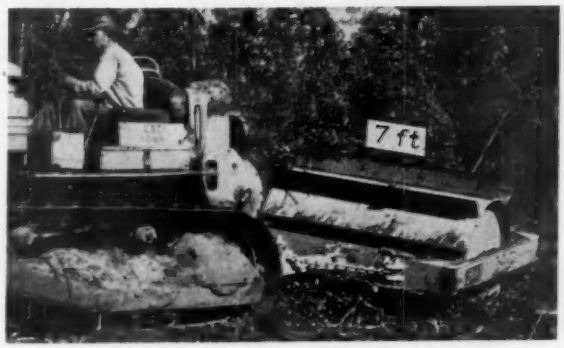
▶ ▶ ▶ New Equipment Section

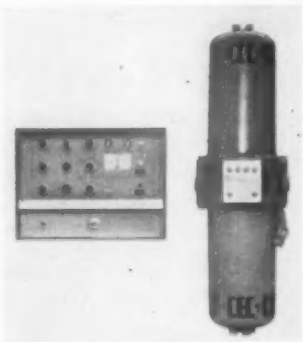
This week's SHOWCASE features . . .

A practical way to kill right-of-way growth

A SINGLE-DRUM rolling chopper has been developed to kill right-of-way growth. The Model SS-7 chopper is a single-drum straight-blade rolling type. According to the maker, it makes a fast method for killing undesirable growth up to 6 in. in diameter. Small undergrowth is chopped completely. Larger growth is cut and fractured to enable the sap to drain out and kill the vegetation.

The device has ten reversible cutting blades of abrasive-resistant alloy steel. It cuts a 7-ft. swath. When filled with water, it weighs about 12,000 lb. It easily attaches to standard tractor drawbars. Delivery: 2 weeks. Approximate price, f.o.b. factory: $2,955. Source: **Fleco Corp., Box 2370, Jacksonville, Fla.**

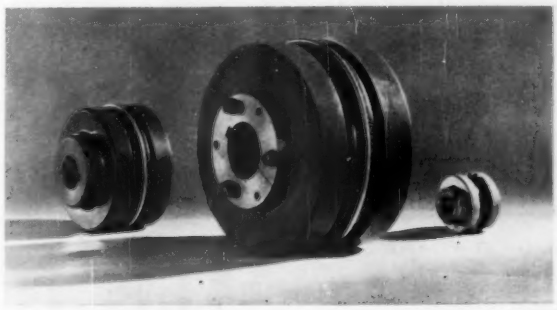




Faster analysis

. . . possible with a new process chromatograph now available that also features automatic programing of up to eight streams. The Type 26-212 instrument makes analyses of liquids, gases, or vapors in one-twentieth to one-fiftieth of the time required by conventional chromatographs, depending upon the product, the maker claims.

Two separate units make up the chromatograph. The analyzer unit is housed in an explosionproof housing for onstream installation in hazardous areas. The control unit can be located on a control panel up to 500 ft. from the analyzer. Approximate list price, f.o.b. factory: $5,100 plus modifications for the application. Source: **Consolidated Electrodynamics Corp., 360 Sierra Madre Villa, Pasadena, Calif.**



Flexible couplings for 1.5 to 6 hp.

. . . at 1,750 r.p.m. called Junior Sure-Flex now available come in sizes for stock bores from ⅜ to 1⅛ in. The flanges are cast from zinc alloy with a tensile strength of 41,000 psi.

The couplings have only three components: two cast flanges and a one-piece rubber sleeve. The molded teeth of the flexible sleeve lock into the teeth of the flanges without clamps or screws, tightening under torque to provide s m o o t h transmission of

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Described in OIL and GAS JOURNAL · Issue of May 9, 1960

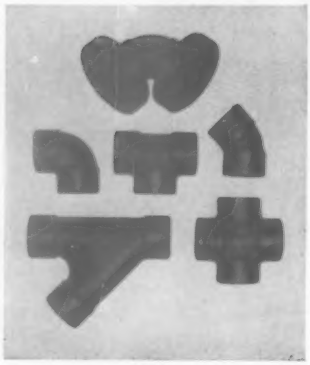
NAME ..... TITLE .....

COMPANY .....

ADDRESS .....

CITY ..... STATE .....

power. The couplings have no metal-to-metal contact. Delivery: immediate. Approximate list price, f.o.b. factory: from $3.25 for Size 3J (1.5 hp.) to $6.25 for size 5J (6 hp.). Source: **T. B. Wood's Sons Co., Chambersburg, Pa.**



●

Epoxy fittings

. . . for pipe are available. The line comprises over 430 different patented fittings in sizes from 1 to 6 in. According to the maker, the glass-fiber reinforced epoxy fittings offer excellent resistance in the transfer of a wide range of corrosively active liquids. They are available in grades for working pressures up to 1,000 psi. The fittings are available with AST (ASTM-D1694-59T) threads, I. P. threads, and flanged or socket type for high-strength cement bonding. Source: **Ed Conley Plastic Corp., Ninety-first and Delaware, Tulsa.**

●

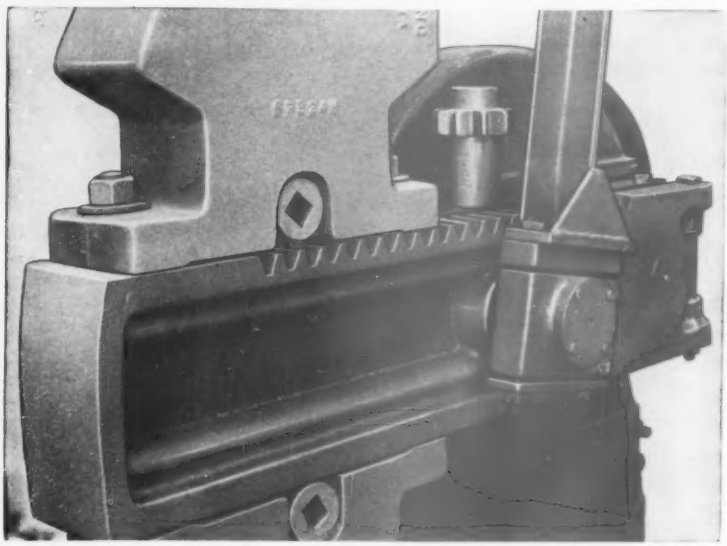
Asphalt pavement

. . . patching device now being produced provides a method for smoothing patch spots, sealing the surface, and bonding the patch to the surrounding area. It uses heat in applying patches in asphalt paving, both cold and hot mix. The Hot Witch roller consists of a heavy roller inside which is a propane-fired heater capable of heating the roller to 800° F. in 4 minutes. It is propelled by hand. A 20-lb. bottle of propane mounts on top of the machine to provide 6 to 8 hours fuel for heating the roller. Price is about $395. Source: **Witch Marketing Co., 1959 West Fir Avenue, Perry, Okla.**

●

Trencher operated

. . . by one man is now available that weighs only about 1,080 lb. and can be easily skid-loaded into pickup trucks or small trailers or transported short distances under its own power



The simple rack-and-pinion system on the JENSEN Rotary Balanced JACK can be adjusted by one man—standing on the ground. Provides a smoother stroke throughout the pumping cycle. Assures longer, trouble-free service from sub-surface equipment as well as the pumping unit. Uses less power too! It will pay you to investigate—let us tell you of the benefits obtained by present users!

This is Jensen's ONE MAN ADJUSTMENT

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P. O. Box 477-F, Coffeyville, Kansas
Export Office: 250 Park Avenue, New York 17, N. Y.

JENSEN JACKS

at 3 m.p.h. The Model MA-2 machine gives five digging widths from 2¾ to 8 in. and digs to 54 in. deep.

At a 2-ft. depth, digging speed averages 205 ft. an hour with an 8-in. width. At a 4-ft. depth, digging speed is about 105 ft. an hour at a 4-in. width. Delivery: immediate. Approximate list price, f.o.b. factory: from $1,441 to $1,586. Source: **Arps Corp., New Holstein, Wis.**

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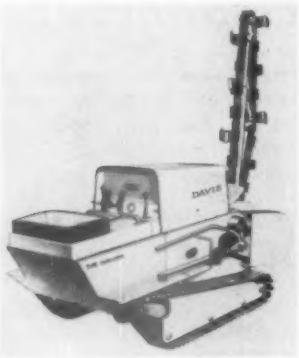
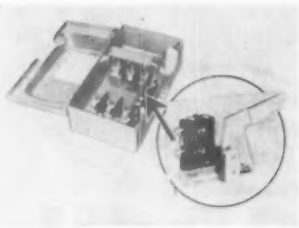


Trencher, backfiller

. . . now available, the T-66, is a crawler type that digs 3 to 4 in. wide down to 66 in. deep or 12 in. wide down to 30 in. deep. The machine travels at speeds of 1 to 12 ft. per minute. A hydraulically driven two-speed gear reducer transmits the power to the drive clutch. A hydraulic valve controls creeping speed. A 12.5-hp. air-cooled engine powers the machine. Complete operation is controlled from the operator's seat. Price: from about $1,995 to $2,177. Source: **Davis Mfg. Co., 1500 South McLean Boulevard, Wichita 13.**

●



Electrical interlock

. . . kit is being produced that permits field installation of additional contacts in safety switches. Because the interlock contacts make or break ahead of the main switch blades, the interlock can be used within control circuits, the maker says. It's available for all Square D heavy-duty safety switches. Price ranges from about $15 to $35. Source: **Square D Co., 1601 Mercer Road, Lexington, Ky.**

●

Tantalum tubing

. . . in 60-ft. lengths is now being produced. The seamless tubing, formerly available only in shorter lengths, is virtually unaffected by highly corrosive acids of all kinds. It is made by extruding a solid piece of metal through a die.

The tubing is available in sizes from 0.453 to 1.5 o.d., wall thicknesses from 0.015 to 0.125 in., and in lengths up to 60 ft. Source: **Wolverine Tube Div., Calumet & Hecla, Inc., 17200 Southfield Road, Allen Park, Mich.**

●

Float-operated tank and sump drains

. . . recently disclosed are designed to collect and automatically discharge large volumes of moisture and sludge from compressed air systems. Flow of air through the Models 5100-4 and 5101-8 drains is not required for operation. Contamination will be auto-

Practical ideas for BETTER Cathodic Protection

DETERMINING CURRENT REQUIREMENTS TO STOP CORROSION OF OIL WELL CASING

Would an experienced corrosion engineer make these mistakes in running current requirement tests for protection of a bare pipe line:

(1) **Use an electrically isolated lateral line as the ground bed?** The answer is, of course, "No." Current distribution along the line—the single most important factor in cathodic protection—is a function of the distance of the ground bed from the pipe line.

The same principle applies to the casing in oil and gas wells, because the casing is simply a vertical pipe line. The current required for external protection cannot be resolved by the Log Current-Potential method if the flow line—insulated off or disconnected at the well head—is used as the ground bed. This fallacy has been demonstrated many times by measuring the current pick-up along the casing with the down-the-hole potential-drop test.

If factual data is to be obtained, a temporary ground bed positioned the same distance out from the well as the permanent ground bed must be used.

(2) **Measure pipe-to-soil potentials with the reference half-cell located on the opposite side of other pipe lines?** Again, the answer is "No." Also, in running Log Current-Potential curves on wells, it is important that the half-cell have an unobstructed view of the well under test.

Your best assurance of obtaining factual information from current requirement surveys on wells is to call CSI engineers. They developed the surface instruments and techniques used to run Log Current-Potential curves which correlate best with down-the-hole potential-drop tests. They have almost a quarter of a century's experience in successful cathodic protection.

Call or write today for estimates or competitive quotations on engineering and installation services, and on quality supplies—for both rectifier and magnesium anode installations.

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What pressure gauge for your particular need?

The clear-cut economical answer to your specific gauge problem is right here in the Marsh line. It is here because the Marsh line contains the world's most complete range of gauges in the three broad brackets of gauge applications.

THE "MASTERGAUGE" GROUP...for those extreme services that demand the ultimate in gauge precision, accuracy and stamina.

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While these three brackets run a wide gamut of prices, the difference between them is not so much a matter of *grade* as a matter of *kind* and *purpose*. All gauges in all groups reflect Marsh precision and quality. Collectively they cover practically every conceivable gauge requirement.

The answer is in the catalog...but if you have a special problem let our engineering department work with you to select the most efficient, most economical solution to your problem.

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"THE STANDARD OF ACCURACY"

matically drained as long as 10-psi. air pressure or more remains in the air system.

The drain valves of the units are automatically operated by rising sludge as it collects in the sump, raising a float. The Model 5101-8 is capable of collecting and discharging up to 500 gal. of liquid contamination an hour. Maximum operating pressure for both units is 250 psi. They are available in pipe sizes of ½ and 1 in. Price ranges from about $29.50 to $74.50. Source: **Wilkerson Corp., 1595 West Girard, Englewood, Colo.**

●

LPG pump

. . . delivers 23 g.p.m. when driven by a 1-hp. motor at 1,750 r.p.m. and operating at 100 psi. differential pressure, or up to 300 psi. differential pressure if required. The Model BF-25 pump is direct-motor-driven. It is expected to prove useful for servicing of bottles, tractors, cars, and trucks with L.P. gas from central storage, dispensing units, or underground storage. Price ranges from about $150 to $185. Source: **Superior Industries, Inc., 1007 National Bank of Commerce Building, New Orleans, La.**

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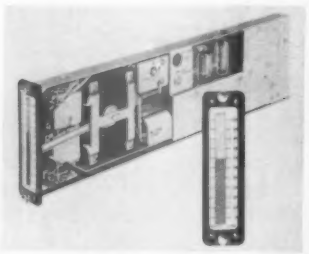


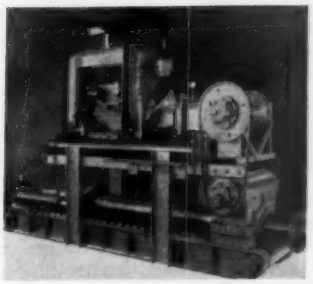
New ribbon indicator

. . . takes up little space. The electronic indicator measures only 2 by 5⅞ in. It's for use in regular panels where space is limited, or in graphic panel installations. The A22M indicator is a high-amplification, null-balance device that operates on the common 0-0.5 volt a.c. signal. It can be obtained with one or two alarm contacts. Price: from about $107.50 for a standard unit up to $153 for one with high and low alarm contacts. Source: **Swartwout Div. of Crane Co., 18511 Euclid Avenue, Cleveland 12.**

●

Under-road boring

. . . machine on the market permits faster and easier installation of pipe under streets, highways, and railroads, claims the maker. The new model machine has the power unit mounted directly above the boring unit. The 35-hp. power unit, with four-speed transmission and reverse, is mounted on its own pipe skid base. It is easily removed if needed.



The machine bores and installs, in one operation, casing with a 6 to 30-in. diameter. Casing is rotated by the

WISCONSIN-POWERED pump speeds filtration in disposal and water flood projects

This application typifies the adaptability of Wisconsin Engines for oil field jobs. And it proves that now you can enjoy the benefits of trouble-free air-cooled power on jobs in the higher hp range.

The Wisconsin-powered pump meets the need for efficient, low-cost filtration of water prior to injection into sub-surface formations. Used extensively in both disposal and water flood projects, the unit periodically backwashes the filter at a rate of 1160 gpm at 50 ft. tdh.

Like all Wisconsin Engines, the powerful VR4D is custom-engineered for the job. It's a heavy-duty precision-built unit in every detail. It is designed to work better and to last longer. Since it is air-cooled, you can depend on it in sub-zero cold or in 140° F. heat.

Look at the features . . . a 12-volt electric starter for fast, easy starts . . . cut-out switches that automatically protect the engine against damage due to low oil or high temperature conditions. Stellite valves and inserts and valve rotators extend valve life up to 500%.

Specify Wisconsin air-cooled Engines on your utility units. Choice of single-, two-, and V-type four-cylinder models — 3 to 56 hp. Tell us your needs and we will tailor the engine to your machine or job.

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Oil Field Distributors for Wisconsin Engines and all types of Utility Units

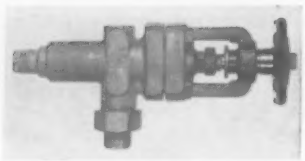
56-HP VR4D ENGINE with clutch take-off assembly, is direct-connected through a flexible coupling to a 5 x 6-R Mission aluminum-bronze centrifugal pump.

boring machine and pushed forward by two hydraulic cylinders. Price is about $7,300. Source: **Young Engine Corp., Canton, Ohio.**

●

Angle valve

. . . does two jobs as it can be used in liquid-level gaging and in instrument piping. The No. 74 valve is designed to prevent freezing and to eliminate wear due to galling. The threaded portion of the stem is outside of the valve body where it is not affected by temperature or action of the liquid.



The reciprocating stem is also back-seating and moves back and forth from the seat in a straight line without rotating, thereby preventing seat wear from galling. The valve is rated at 1,440 psi. at 100° F., ASA. Price is about $38.75. Source: **Jerguson Gage & Valve Co., Adams Street, Burlington, Mass.**

Portable winch hoist

. . . rated at 1,000 lb. is equipped with 15 workable ft. of 3/16-in. diameter, 7 by 19 construction, 133-strand aircraft cable, yet weighs only 7 lb. You can use it for many lifting jobs, as well as lowering, pulling, stretching, and bending. It operates smoothly when rigged right side up, up side down, horizontally, or at an angle. Price of the Model 1000-15 hoist is about $29.50. Source: **Lug-All Co., 355 Lancaster Avenue, Haverford, Pa.**

●

Liquid-level controls

. . . available now, the NM-1 and NM-2 Magnetrols, are designed so all parts in contact with liquids or vapors are nonmetallic. The controls are for use in controlling liquids that present problems in handling. According to the maker, they are immune to galvanic or electrolytic attack, corrosive-resistant, and have smooth surfaces that discourage any tendency for scale or deposits to form. They are for use in controlling any liquid of specific gravity of 0.70 or above. Chamber and float construction are for service at 100 psi. at 70° F. or 50 psi. at 140° F. Source: **Magnetrol, Inc., 2110 South Marshall Boulevard, Chicago.**

●

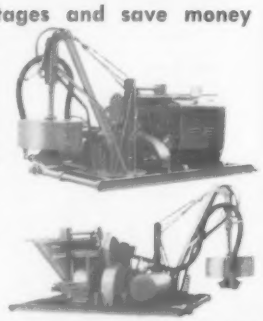
Gas chromotography

. . . analyzer now available includes Golay columns and ionization detectors and features rugged mechanical and electrical components to meet the requirements of longer and higher temperature analyses. Features of the

New Mudmixer Makes Other Mixing Methods Obsolete and Costly

Compare Thompson's field proved advantages and save money

Automatic feed and mixer gives close control of dry muds and chemicals (except caustic soda) and mixer delivers mud to system thoroughly mixed. Actual field tests have proven an *increase in jel yield of 15% to 30%* over hand feed and jet mixing methods. Thompson Mud and Chemical Mixer is a complete unit with pump and power.



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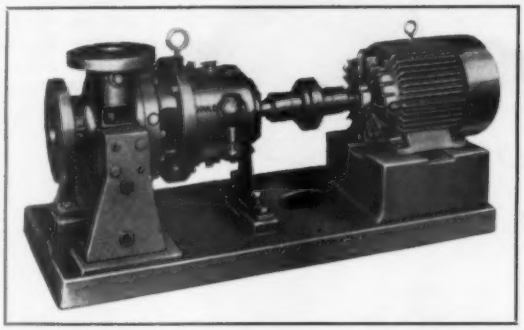
Robert Fornesi, Senior Application Engineer, Goulds Pumps, Inc.

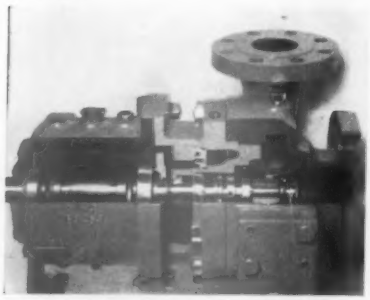
Changing requirements created this third dimension in process pump selection



Once upon a time you had to meet petroleum process applications with pumps in only these two ranges: (1) Light duty pumps to handle temperatures up to 200° or at most 300°. (2) Real heavy duty pumps for 200° to 800°. That's changed.

Here's why. Goulds product development group appraised the growing range requirements and services of petroleum process pumps. They found that 200° was no longer a realistic dividing line for process pump types. The need was for one pump which would handle all light duty applications and the growing number of intermediate applications as well.

Why should you have to buy a light duty pump with built-in temperature limitations when an intermediate-range pump could be built for almost the same price? Why should you pay for an 800° heavy duty pump to handle all the applications above 200° or 300°?



THIS DESIGN SOLVES HIGH TEMPERATURE SEAL PROBLEMS

Goulds designers felt they had the answer to both these questions in their plans for the Model 3775 line. This was not enough.

The design concept was verified by field research. The plans were rolled up from the drawing board and flown and shown all over the country. Plant superintendents and operating engineers saw them. They said yes.

They liked the rather obvious ideas that made INTERMEDIATE DESIGN POSSIBLE . . . the mechanical seal isolated in a seal chamber. This to allow for cooling of the liquid within the seal chamber. It made higher temperature handling with mechanical seals possible as it protected the seal. In similarly priced pumps the mechanical seal area behind the impeller is wide open. The hot pumpage is in constant contact with the seal. With the Model 3775 seals are not exposed to direct contact with hot pumpage. Cooler seals mean longer seal life.

COOLED CASING SUPPORT . . . A PLUS FEATURE

This was not enough. To be completely fit for INTERMEDIATE-RANGE (up to 650°) applications the Model 3775 had to have these features of costlier heavy duty pumps—cooled bearings and casing support.

Goulds Model 3775 has them all—water-cooled bearing housing and casing support as well as the seal chamber. This plus the choice of either internal or external flushing of the seal chamber. Single, double, balanced or unbalanced seals available to properly fit the application.

The pump is back pull-out type for easy maintenance. A spacer coupling allows you to remove the rotating parts without disturbing pipe connections or driver.

Built in accordance with API 610 specs, the fine mechanical features of this pump provide a husky line of pumps with maximum standardization and interchangeability of parts. Eleven sizes are built on the same bearing frame.

The Model 3775 is a horizontal center line mount with vertically split casings. Renewable casing wearing rings maintain proper clearance with impeller wearing rings. Leakage between suction and discharge chambers of the casing can be held to an absolute minimum.

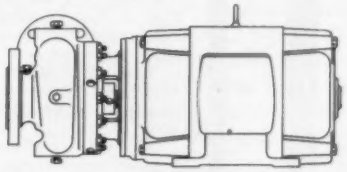
Talk over your process handling methods and problems with your Goulds engineer. He'll show you many more reasons why the INTERMEDIATE-RANGE 3775 is your best process pump choice for the majority of applications . . . *why it makes light duty pumps obsolete.* How it better fits the growing range of your process requirements.

AND AT LAST . . . A CLOSE-COUPLED PROCESS PUMP!

Goulds Model 3675 is the close-coupled version of the 3775. These units use the same liquid end as the frame mounts. The 3675 casing may be swiveled to four different discharge positions.

This integral pump-motor design provides the maximum in economy and compactness. Flexibility, too! One of our customers changed a process. A steel-case pump was required. Buy all new units? No, Goulds Model 3675 liquid ends fitted on the customer's present motors and provided the same rating. Only the casing was changed.

Get the complete story on these new pumps and all the others in the modern Goulds line. Send our factory the coupon below.



GOULDS PUMPS

GOULDS PUMPS, INC. Dept. 06J-50 Seneca Falls, N.Y., U.S.A.

Send me a bulletin with complete application data on your INTERMEDIATE-RANGE DESIGN petroleum process pump.

Anything else? Please check.

- ☐ 1-stage centrifugal—Model 3405
- ☐ 2-stage centrifugal—Model 3305
- ☐ Steel case Pumps Bulletin

NAME _____ DEPT. OR TITLE _____

COMPANY _____ ADDRESS _____

CITY _____ ZONE _____ STATE _____

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'CHROME CLAD®
won't rust, chip
or peel

There's no paint on Lufkin Chrome Clad "Atlas" Oil Gaging tape lines.

The bold, black markings are bonded to the basic metal . . . protected with several electroplatings that give extra strength to the line. The final metal coat is Lufkin's exclusive Chrome Clad finish. Glare-free, smooth, rust resistant . . . the most durable tape line you can buy.

It's 50% heavier *than standard-weight steel tapes. Shows oil level clearly. Wipes clean easily. In lengths from 18 to 100 feet.*

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MACCO
TIME TESTED PRODUCTION EQUIPMENT

MACCO PARAFFIN SCRAPER—SUBSURFACE PLUNGER
(Lubricator and Plunger)

The Macco Paraffin Scraper is used primarily for removing paraffin deposits inside the tubing string. It has also proven highly successful for unloading sluggish gas wells, flowing wells which are produced by the "stop-cock" method, and as a plunger for lifting fluid in high ratio oil wells.

The lubricator and catch assembly is mounted on the wellhead with the plunger inside. The plunger is dropped through the tubing to a predetermined tubing stop.

The timing of this operation is regulated by a flow line controller, except on intermitting gas lift wells. When the well kicks, the plunger returns to the surface, removing paraffin deposits.

If your well falls under one or more of these basic type wells, check with your Macco representative for further information: or write for Paraffin Scraper Brochure No. 14-02.

- PARAFFIN PRODUCTION
- HIGH GAS-OIL RATIO WELLS
- GAS WELLS THAT LOG UP
- HIGH GRAVITY GAS LIFT WELLS
- STOP-COCK WORK ON LOW PRODUCTION WELLS
- EMULSIFIED FLUID PRODUCTION

MACCO OIL TOOL COMPANY, INC.
1521 Prince P. O. Box 7288 Houston 8, Texas
Phone UN 1-1253

Model 154-D vapor fractometer include also interchangeable packed columns and thermistor and hot-wire detectors. A number of accessories are also available to extend the use of the instrument. Price is about $1,950. Source: **Perkin-Elmer Corp., Norwalk, Conn.**

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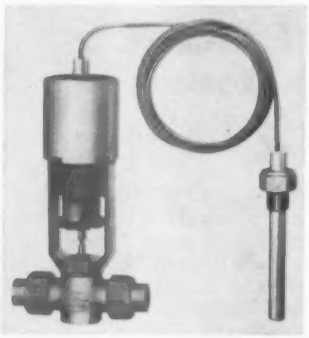

Temperature regulator

. . . that is self-powered is available, especially designed for use on gas-fired petroleum heaters and treaters. The regulator bulb is equipped with a close-fitting, tin-plated steel-bulb well or socket to facilitate installation. A Buna N valve disk is used for tight closure. Valve sizes are ½ and ¾ in. Temperature range is 110° to 190° F. Source: **Robertshaw-Fulton Controls Co., Fulton Sylphon Div., Box 400, Knoxville 1, Tenn.**

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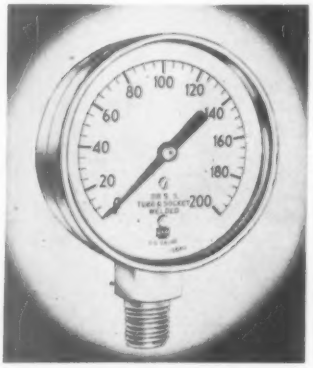
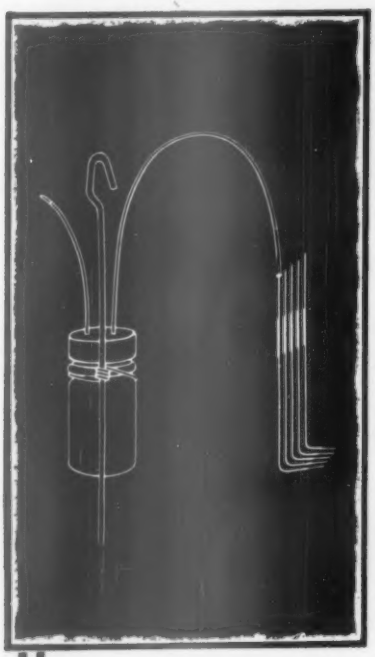


Pressure gage

. . . is available with all components of stainless steel for services involving corrosive atmospheres and media. The gage meets ASA Grade B specifications, including accuracy of 2% at the middle, or working half of the scale (3% for the remainder). Incorporated into the design are a Type 316 stainless-steel bourdon tube, movement, socket (welded), case, and ring. The gage is available in stand-

CANNON PENS



UP TO A YEAR WITHOUT REFILLING

Cannon Meter Pens are easily installed as original or replacement equipment in all standard recording instruments. Produce accurate charts of maximum legibility. No blurring or smearing.

- Ends unrecorded intervals. Unaffected by pulsating flows, chart speeds, or rapid pen movement.
- Sealed ink supply prevents clogging from atmospheric contamination.
- Two-way capillary action ink flow eliminates smearing, blurring.
- Available in five sizes and angles. Special pens designed to customer specifications on request.

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INCORPORATED (ESTABLISHED 1836)

General Offices: Philadelphia 16, Pa.
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SHOWCASE . . .

New Equipment

ard ranges up to 5,000 psi. and in dial sizes of 2, 2½, and 3 in. Price ranges from about $30 to $44. Source: **United States Gage Div. of American Machine & Metals, Inc., Sellersville, Pa.**

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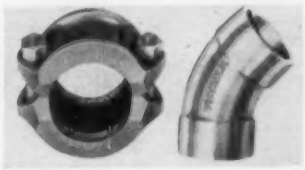


New piping method

. . . developed called the Victaulic Plainlock, promises a simple, leak-tight method of connecting plain-end pipe with positive-grip couplings and fittings. The couplings are designed with two bolts for fast installation and are fitted with hardened stainless steel grips that engage the pipe ends and securely lock them together. An ordinary wrench with normal torque is sufficient to seat the grips in the pipe or fitting ends. Coupling prices range from about $1.60 for a 1-in. to $9.30 for a 6-in. size. Source: **Victaulic Co. of America, Box 509, Elizabeth, N. J.**

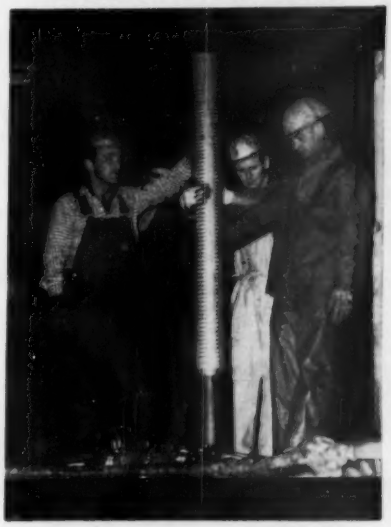
•

Granular lost-circulation material

. . . now on the market is made of an engineered blend of thermoplastic and thermosetting plastics. Each plastic is individually selected for its special properties. Some of the plastics used retain their rigidity and maximum compressive strength over the range of temperatures and pressures found in drilling. They are the structural basis of the seal. Other of the plastics used soften some under deep-hole pressure and temperature. They are thus capable of conforming to openings between the structural members of the material.

The product, tradenamed Plasti-Plug, is inert to mud, chemicals, and petroleum, doesn't absorb water from the mud system, and doesn't affect the chemical balance of the mud system, the maker claims. The product comes in medium and fine grades. The fine grade consists of a controlled blend of sizes from 20 to 100 mesh. The medium grade consists of a blend of sizes from 8 to 100 mesh. Source: **Cherokee Laboratories, Inc., 3021 Sand Springs Road, Tulsa.**

LOOSE SANDS?



SANDBAN SCREEN

Sandban* screen is a new tool for controlling sand production. Sandban screen consists of a slotted aluminum screen, a smaller aluminum or steel screen inside and a permeable network of plastic-coated walnut shells between the screens. Sandban screen is easy to use—and economical. Available sizes: 4-inch O.D. with 1½-inch steel screen inside; 5⅝-inch O.D. with either 2⅞-inch steel screen or 2-inch aluminum screen inside. Other sizes made to order. Ask a Dowell engineer about Sandban screen.

*Dowell Trademark

Products for the oil industry

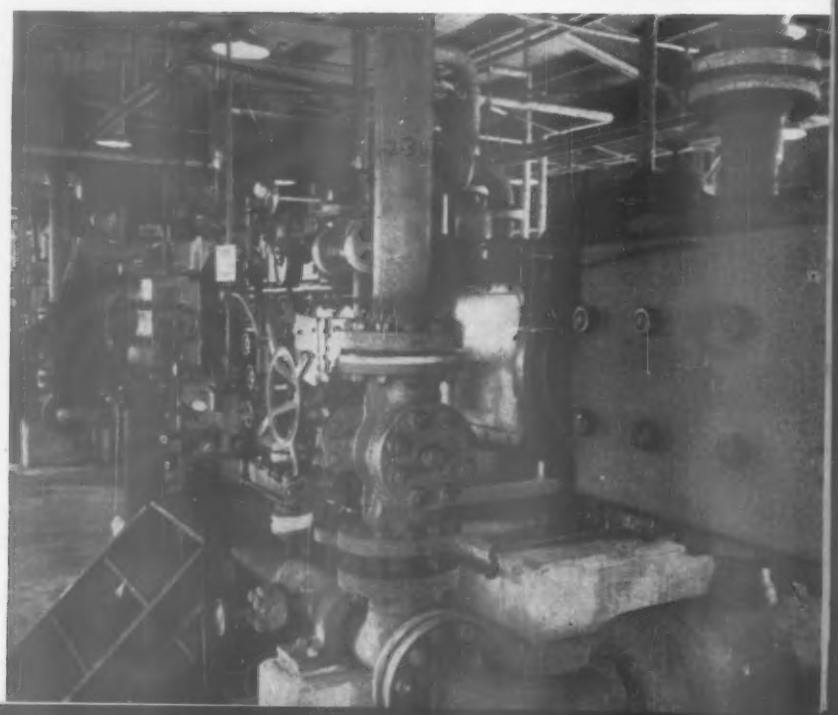
DOWELL

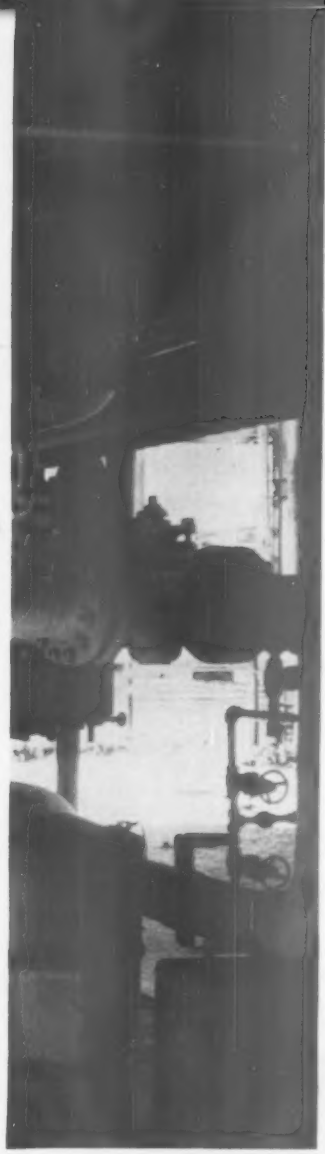
DIVISION OF THE DOW CHEMICAL COMPANY

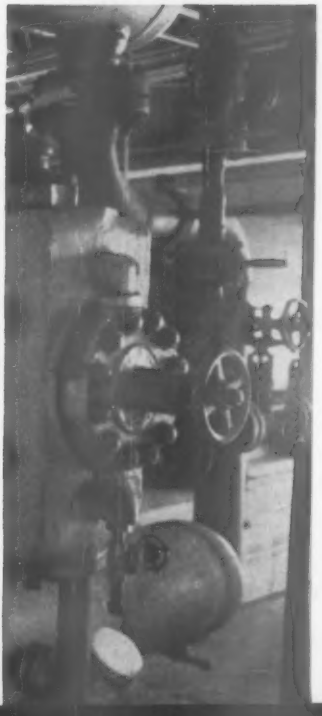
DIAL DOWELL

A 1200 hp Cooper-Bessemer Type FM Compressor which transfers make-up hydrogen to the hydrodesulfurization plants.

600 hp Cooper-Bessemer Type FM Compressors recycling hydrogen within the naphtha (gasoline) hydrodesulfurization plant.







How 7 Cooper-Bessemer Compressors put 700 psi behind sulphur removal

Hydrodesulfurization at Wood River... Shell Oil Company's largest refinery... removes sulphur from 25,000 barrels of high octane gasoline and 25,000 barrels of fuel oil daily. In this process, the job of compressing hydrogen to 700 psi for removal of sulphur belongs to six Cooper-Bessemer Type FM motor-driven compressors. And a seventh FM unit compresses the hydrogen sulphide product to 100 psig for the manufacture of free sulphur... an output of 100 tons per day.

These 7 Cooper-Bessemer Compressors operate 24 hours per day, 7 days per week. Two units are 1200 hp; four are 600 hp and one is 400 hp... all running at 450 rpm.

Cooper-Bessemer engineers will gladly help *you* plan compression and power facilities for refining and petrochemical processing. Write for a copy of "Cooper-Bessemer Equipment for Refineries."

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ethylene glycols
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To give you immediate deliveries, local bulk and drum stocks of the ethylene glycols and ethanolamines are maintained in the Southwest for natural gas processing. At Houston call Ranger Chemical Company; at Odessa and Borger, Texas, or Farmington, N. Mex., call Western Chemical and Supply Company, and at Lafayette, La., call Chemical Service, Inc. .

These products are also stocked by distributors in other areas; carload and bulk shipments are made from the Brandenburg, Ky., plant. For the name of your nearest distributor, samples and technical data sheets, see your Olin Mathieson representative or write for complete information.

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SHOWCASE . . .

New Literature

New lighting fixtures

. . . which are vaportight and explosionproof are described in new Bulletin 5-A, yours free for the asking. It lists many features of the Series V-51 fixtures, including reflector styles, mounting units, and accessories. Source: **Appleton Electric Co., 1701 West Wellington Avenue, Chicago 13.**

Pumps

. . . for tank-bottom circulating are discussed in available 4-page Bulletin 1009. It describes the Duraflex portable rotary pump, also recommended for paraffin removal, wash down, rig supply, and water-charging shallow wells. The publication contains performance data and prices as well as a full page of extracts from field reports giving information on actual pump use and performance. Source: **Marine Products Co., 515 Lycaste, Detroit 14.**

Buttress-thread casing

. . . is the subject of a new 6-page literature piece which has just been published. Folder 1103 contains technical information including threading data, performance properties, and buttress-thread form and cross-over detail. It explains why buttress-thread casing is an economical, high-strength connection with a joint strength virtually as strong as the pipe itself. Source: **Republic Steel Corp., 1441 Republic Building, Cleveland 1.**

Corrosion-resistance

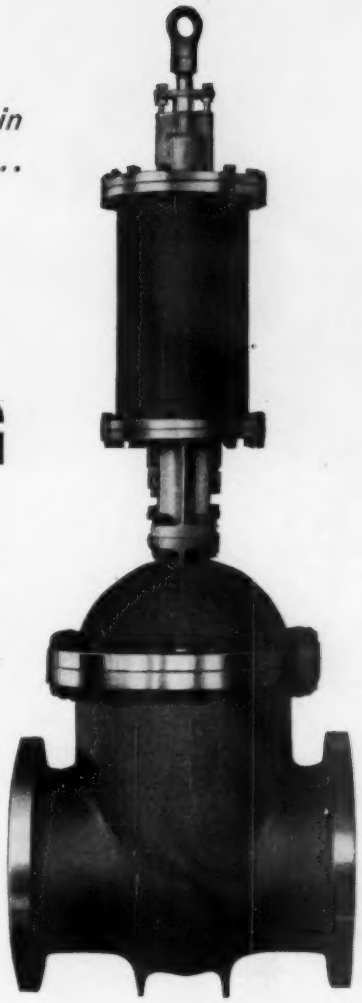
. . . rating guide lists the relative ability of metals, plastics, and synthetic rubbers used in the manufacture of Flo-Ball valves to resist corrosive effects of 390 different fluids. An easy-to-read tabulation permits a fast estimate of the effect of the fluids, alphabetically arranged, on selected construction materials. The 8-page publication also provides physical characteristics and temperature ranges of the plastics and synthetic rubbers. Source: **Hydromatics, Inc., 70 Okner Parkway, Livingston, N. J.**

Arc-welding-electrode

. . . catalog now available describes welding electrodes, gas-welding rod, nonconsumable electrodes, submerged arc-welding flux, and automatic weld-

For frequent operation in inaccessible locations . . .

specify DARLING cylinder-operated GATE VALVES



Here's a valve that's as versatile as you want to make it. It can be readily adapted to your piping conditions or process cycles. For example:

Manual or Automatic Operation may be used—by means of four-way valves which control the flow of fluid or air to the cylinders.

Air, Oil or Water may be used for the operating media—and can be piped from the lines on which the valves are installed.

Engineered for Your Application—Valves can be supplied, piped and equipped with solenoid or pilot-operated control valves, limit switches and positioners for remote or local operation.

Write for detailed information or quotes, giving size of valves required, kind of valves (Iron Body Bronze Mounted, All-Iron, Bronze, Special Alloy, etc.), service conditions, maximum disc pressure and minimum cylinder pressure.

DARLING VALVES

DARLING VALVE & MANUFACTURING CO.
Williamsport 1, Pa.
Manufactured in Canada by Canada Valve & Hydrant Co., Ltd., Brantford, Ont.

Drilling for oil—USS Tiger Brand Rotary Drilling Lines on one of the world's deepest wells—combine strength, toughness and long service life.

From the Tiger's mouth—

How to get

Regardless of the type of equipment you operate or the size, grade or construction of the wire rope you use—when you get better service from that wire rope you save money.

Proper selection and care of your wire rope will pay off in longer rope life and consequent operating economy. Here are 10 ways to increase the life of wire rope:

1. Get the right rope. Carefully examine the operating requirements for your rope, determine how heavy the loads will be, how much abrasive wear, distortion, or crushing the rope must withstand, and how flexible it must be. Then choose the USS Tiger Brand Wire Rope that has the properties you need . . . there is one for every type of job.

2. Unreeling. To prevent kinking, be sure the reel or coil is free to rotate as the rope unwinds. Mount reels on an unreeling stand or on a shaft supported by two jacks. Otherwise, hold the rope end and roll the reel along the ground to unwind the rope. Always use this latter method for coils.

3. Sheaves and drums. Align all sheaves. Be sure that sheaves and drums are free to rotate and large enough in diameter to prevent sharp bending. Grooves must be slightly larger than the rope diameter and, if scored or badly worn, should be reground before new ropes are installed. Sheaves with broken flanges should be replaced immediately.

Strip mining—USS Tiger Brand Hoist Rope for strength with flexibility, Tiger Brand Drag Lines for strength with abrasion resistance, and Tiger Brand Boom Supports for high resistance to vibration fatigue.

Building a super highway—USS Tiger Brand Shovel Rope, Dozer Rope and Scraper Rope give longer service with less down time.

Lifting industrial loads—USS Tiger Brand Slings lift the heavy loads safely. Crane hoist ropes provide strength and flexibility.

more service from your wire rope

4. Wire rope fittings. Install sockets, clips, swaged fittings or spliced loops or thimbles depending upon service requirements. Tiger Wire Rope Sockets, properly attached with molten zinc, develop the full strength of the wire rope.

5. Seizings. To prevent untwisting, apply seizings to the ends of any non-preformed wire rope that is not attached to permanent fittings. When you cut a non-preformed wire rope, apply seizings on both sides of the cut to prevent distortion.

6. Lubrication. Lubricate your ropes regularly with Tiger Lube Wire Rope Lubricant to cut down internal wear and reduce corrosion.

7. Cutting back. It is often advisable to change the position of a rope on sheaves and drums by cutting short lengths of rope from the drum end. This distributes wear more evenly, prevents fatigue from concentrating at any one section of the rope, and increases rope life. If you plan to cut back, order your ropes a little longer than normally required.

8. Reverse ends. Reversing a rope, end for end, will increase its life if half of it gets most of the wear. Reversing distributes wear and fatigue evenly throughout the rope.

9. Storing wire ropes. If you take a rope out of service for any length of time, clean and lubricate it thoroughly. Then store it in a dry place, protected from the weather.

10. When in doubt. If you need help in selecting the right rope or in setting up good maintenance procedures, call in a Tiger Brand Wire Rope Engineer. He can give you expert advice on any wire rope problem. Just call our nearest distributor or send the coupon.

USS and Tiger Brand are registered trademarks

USS

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Cleveland 13, Ohio

Please send me a copy of your booklet, "Longer Life from your Wire Rope."

Name _____

Position _____

Company _____

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City _____ **Zone** _____ **State** _____

• The Skelly Oil Company kept the area around these butane-propane storage tanks completely free of weeds for a whole season by spraying the ground with Du Pont "Telvar".

Get season-long control of fire-hazardous weeds —spray once with a Du Pont Weed Killer

No fire hazard here from weeds. No expensive or difficult weed-control program, either. Just a simple weed-control maintenance program with a Du Pont weed killer kept the area around these storage tanks clean. One spraying of Du Pont "Telvar" monuron or "Karmex" diuron weed killers provides safe, economical weed control around refineries, storage tanks, pipelines and producing fields for a season or longer. Fire hazards are eliminated.

Five-year records of several petroleum companies show that Du Pont "Telvar" and "Karmex" cut weed-control budgets from 50 to 75%. "Telvar" and "Karmex" are non-flammable, non-volatile, non-corrosive and low in toxicity to man and animals. Contact Du Pont for information on which weed killer is best suited to your soil type and moisture conditions—write Du Pont, 2543 Nemours Bldg., Wilmington 98, Delaware; in Canada: Du Pont of Canada Ltd., P. O. Box 660, Montreal, Quebec.

On all chemicals, always follow label instructions and warnings carefully.

DU PONT
REG. U. S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

Weed and Brush Killers

TELVAR® monuron weed killer · **KARMEX®** diuron weed killer · **AMMATE® X** weed and brush killer · **TRYSBEN® 200** weed killer · **DYBAR®** fenuron weed and brush killer

ing wire. In addition to a handy application diagram, the 28-page catalog explains the AWS classification numbers, defines mechanical-property terms, color codes, and gives eight factors to consider in selecting welding electrodes. Source: **Hobart Brothers Co., P. O. Box EW-212, Troy, N. Y.**

Sample board

. . . of drive screws, nails, which should simplify your selection problems, is now being offered free for the asking. The 12 by 16-in. board can be either hung on a wall or stood up on a counter for quick, easy reference. Mounted on it are samples of 23 nails of different sizes in 6 different types. The number of each nail per pound is also shown, along with uses for each type. Source: **Hillwood Mfg. Co., 21700 St. Clair Avenue, Cleveland 17.**

Liquid-desiccant

. . . brochure deals with Hi-Dry, a tetraethylene glycol for removing water from natural gas, that can be used in conventional glycol absorption-dehydration plants. Source: **Jefferson Chemical Co., Inc., 1121 Walker Avenue, Houston 2.**

Leak protection

. . . is provided for all types of threaded pipe connections by using Tape-Seal, according to a free, two-page brochure. It states that the chemically inert plastic protects connections even under extreme conditions of temperature, pressure, or corrosive atmosphere. Free samples are contained in the literature. Source: **Friesland Plastics Co., Friesland, Wis.**

One-coat

. . . protective-coating system named Primastic—for severe exposure protection—is detailed in 2-page Bulletin 540A now available. Described as a fibrated epoxy mastic, the coating combines rust-inhibitive primer properties with both organic and inorganic chemical resistance. The bulletin contains data on the chemical and physical properties of Primastic, along with its applications and costs. Source: **Prufcoat Laboratories, Inc., 63 Main Street, Cambridge 42, Mass.**

Pressure-gage

. . . Bulletin DH-333 describes Type 110 multipurpose Gearcoid gages. The four-page folder states that the gages

New giant fire-killers!

Illustrated: 400 pound pressurized dry chemical

200 and 400 POUND DRY CHEMICALS FROM KIDDE!

Now – kill more fire – faster – with these new, giant, pressurized dry chemical extinguishers from Kidde! Ideally suited for fighting chemical, oil, gas and electrical fires, these new Kidde units pack an extra fire-killing punch, give you maximum protection in a minimum package.

Like all Kidde fire extinguishing equipment, these new dry chemicals give sure, dependable performance, feature fast, easy operation even with inexperienced personnel. Check the many features that these new Kidde units offer . . . then check the fire hazards in your own plant. Chances are you need a lot more fire protection. It's a good idea to make it *Kidde!*

For additional information on these and other Kidde fire extinguishers and systems, write to Kidde today.

- Easy-to-read dustproof and moisture-proof pressure gauge tells at a glance if unit is ready for operation.
- Exclusive Bridgeman Seal gives a three-ton locking pressure on head of unit to make it leakproof and tamper-proof.
- Simple, fast operation lets you get the jump on any fire. The units give you shut-off valve control at the nozzle too.
- Special Kidde universal nozzle gives long-range discharge pattern without any turbulence. 40′ discharge range.
- Both 200 and 400 pound units can be installed either free-standing or wall-mounted. 50′ or 100′ of hose.
- Underwriters' Laboratories-approved.

Kidde

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554 Main St., Belleville 9, N.J.
Walter Kidde & Company of Canada Ltd.
Montreal — Toronto — Vancouver

MUDDY GOING IN MOSCOW

Moscow, *Kentucky*, that is. That's where our photographer had the muddiest assignment of his career. But his problems were trifling compared to those of the men who had the job of laying 30-in. pipe for Trunkline Gas Company. For them, hipboots were standard dress. Fortunately, men and machines proved to be hardy "mudders," and the line went through.

The project was Panama, Inc.'s Spread Two, extending south from Clinton, Kentucky to the vicinity of Union City, Tennessee. Bethlehem Line Pipe was used on this and other spreads in Trunkline's current program, which calls for 895 miles of looping lines and an extension of their main line to the Michigan-Indiana border.

TRENCH OR DAM? Mud wasn't the pipeliners' only problem. Heavy rains soaked the earth, causing numerous cave-ins.

THAT'S MORE LIKE IT! The going was a lot smoother on this Trunkline spread near Leland, Mississippi. Here, too, both Panama, Inc., and Bethlehem pipe were on the job.

Bethlehem Line Pipe from ½ to 42 in. OD

Bethlehem supplies line pipe in all sizes, including continuous buttweld (½ in. through 4½ in.), electric resistance-weld (5⅝ in. through 16 in.), and electric fusion-weld (18 in. through 42 in.). In the larger diameters, Bethlehem is now able to furnish walls up to ¾ in. thick.

Need line pipe? Just call our nearest sales office.

for strength
... economy
... versatility

Steel

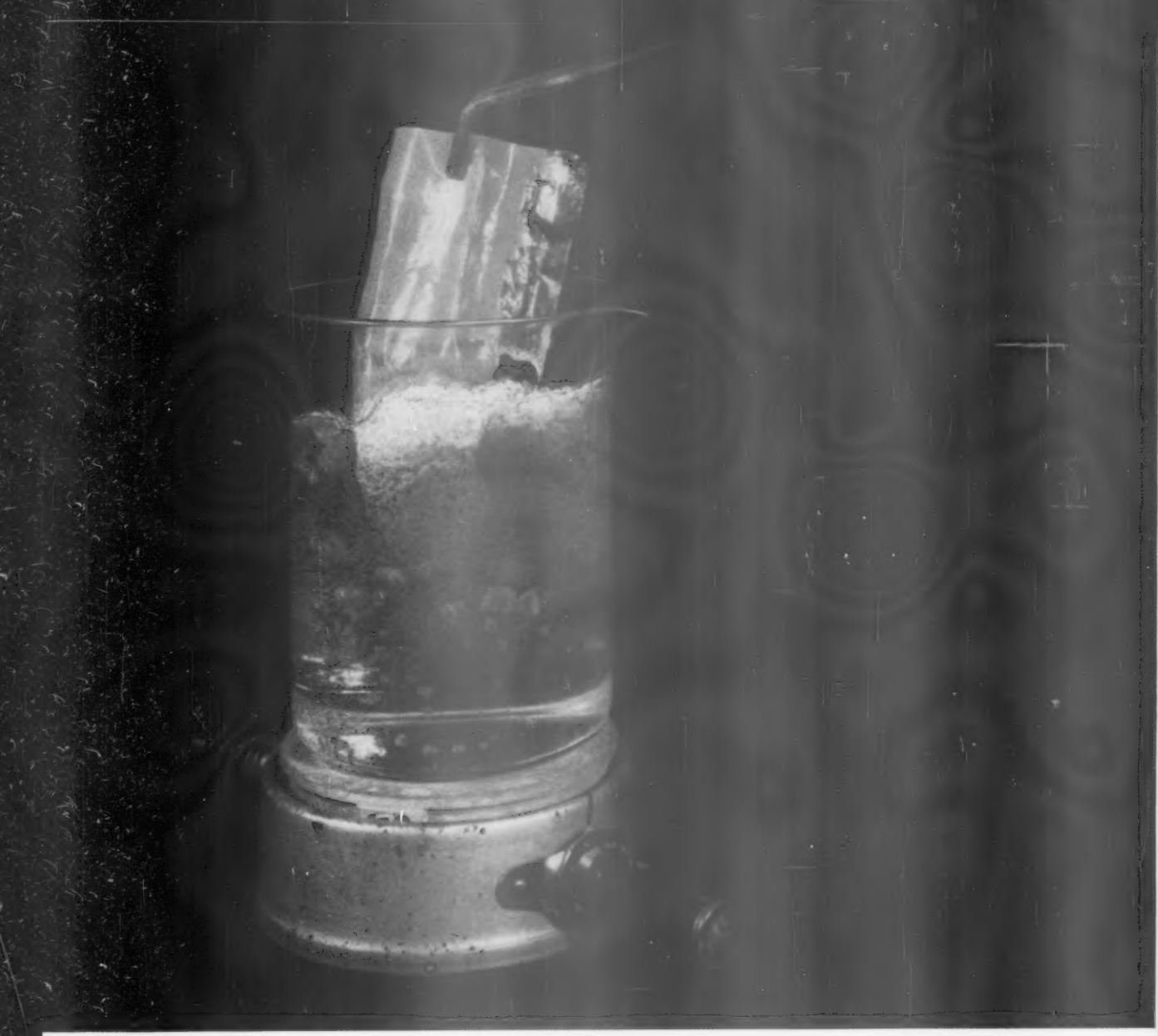
THERE'S MUD IN ROME, TOO! Rome, New York, that is. Pipeliners are shown here wrestling with Bethlehem 6⅝-in. OD electric resistance-weld pipe for Buckeye Pipe Line Company's jet fuel line to Griffiss Air Force Base.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



Hot caustic can't foil this coating

A Glidden NU-PON COTE system was applied to foil and immersed in boiling 60% sodium hydroxide. The foil dissolved completely in a short time. The chemical resistant film was unharmed—and stayed that way!

Glidden coatings must submit to a whole battery of grueling tests such as this, because Glidden experts have to be sure before they recommend a protective system.

Glidden Protective Maintenance systems are designed to keep ships, marine installations, petroleum equipment, chemical plants, railroad rolling stock and industrial properties on the job under highly corrosive conditions.

QUALITY Glidden PRODUCTS

COATINGS FOR EVERY PURPOSE

The Glidden Company
INDUSTRIAL PAINT DIVISION
900 Union Commerce Building • Cleveland 14, Ohio
In Canada: The Glidden Company, Ltd., Toronto, Ontario

Write for your free copy of booklet containing complete information on all Glidden Protective Maintenance coatings.

come in 20 ranges and are recommended for oil, air, water, steam, gas, or other media not corrosive to brass or bronze. The publication includes details of construction, specifications, pressure ranges, and dimensions. Source: **Helicoid Gage Div., American Chain & Cable Co., Inc., 929 Connecticut Avenue, Bridgeport 2, Conn.**

Pipe-wrap tape

. . . for control of corrosion is discussed in a new six-page folder that lists product data on two vinyl pipe-wrap tapes, a polyethylene pipe-wrap tape, and a pipe-wrap primer. A comprehensive chart gives pipe-wrap-coverage data and tape specifications. Source: **Permacel, New Brunswick, N. J.**

Tank-preparation

. . . wall chart entitled "Prepare and Design Tanks for Lining," an 8½ by 11-in. chart, diagrams seven factors to consider in the proper design and preparation of tanks to be lined to prevent tank corrosion and product contamination. Source: **Protective Coating Div., Metalweld, Inc., Scotts and Abbettsford Avenue, Philadelphia 29.**

Auxiliary-check-valve

. . . brochure describes basic applications, construction features, and operation of a new resilient-sleeve check valve for multiple-completion gas-lift installations. Two-page Brochure 2-13 presents parts and specifications for two models. Source: **Macco Oil Tool Co., Inc., P. O. Box 7288, Houston 8.**

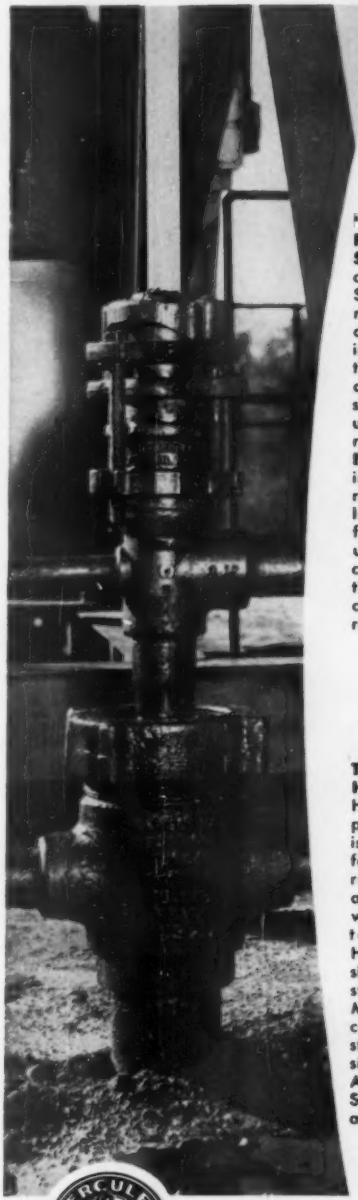
Cut pump pressures

. . . in half or double injection rates by using new friction-reducing addition agents—J98, J99, or J100. A new graph shows the reduction in friction which is possible by using these agents. Source: **Dowell Division of The Dow Chemical Co., P. O. Box 536, Tulsa.**

Paint your way

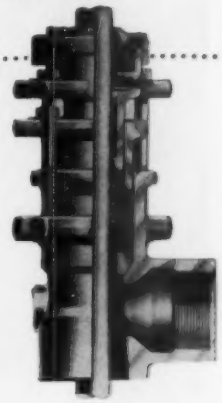
. . . to Fire Safety is the title of a new 12-page publication which explains how fire-retardant paint works and how it is applied in all types of buildings to improve personal safety and to reduce potential fire damage. Bulletin 100 discusses relative costs of materials and labor in applying conventional decorative paints and fire-retardant paint, and explains Underwriters' Laboratories flame-spread ratings. Source: **Albi Mfg. Co., Inc., Rockville, Conn.**

HERCULES products in ACTION

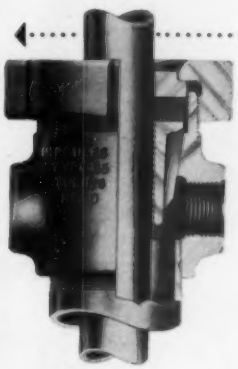


A typical set-up is shown below in Creek County, Oklahoma, using Hercules "Tee Type" Duplex Polished Rod Stuffing Box and Type "ES" Tubing Head. This is an easily assembled, effective and economical producing unit.

"TEE TYPE" DUPLEX POLISHED ROD STUFFING BOX—A combination Tee and Stuffing Box with female thread to screw directly onto the tubing, eliminating one threaded connection and resulting in a considerably shorter hook-up. With internal parts removed, the Stuffing Box body is full opening and need not be removed to pull rods. In addition to being furnished in the most used sizes, special combinations of threads and outlets can be furnished on request.



TYPE "ES" TUBING HEAD—This Tubing Head is ideal for any pumping situation. It is economical enough for shallow wells and rugged enough for any depth well, with working pressure up to 1500 pounds. Hercules self-aligning slips suspend the inner string in this Head. Mandrel suspension can be furnished instead of slips, if desired, at no extra cost. A neoprene Tubing Stripper Unit is also available.



Write for complete information on any Hercules Product.

HERCULES TOOL COMPANY

MANUFACTURERS OF OILFIELD EQUIPMENT

GENERAL OFFICES AND PLANT • TULSA, OKLAHOMA

Export Representative Oil Field Equipment Co., Inc. 90 West Street, New York, N. Y.

Greater power delivery in less space

with DAYTON POLY-V® DRIVES

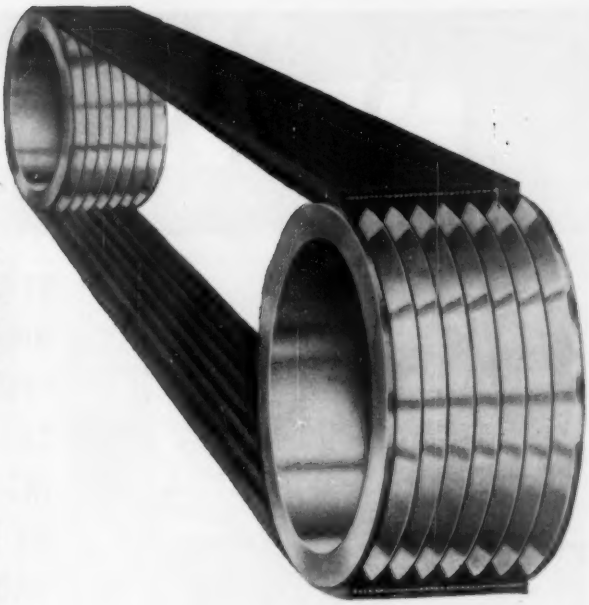
Next time you're in the fields, check the drives that are being used on vital equipment like this Gardner Denver Natural Gas Compressor. Odds are, you will note a new kind of V-Belt is becoming more and more popular . . . the Dayton Poly-V Belt.

At first it appears to be just an ordinary flat belt, but look closer. You'll find a series of precise ridges on the inside of the belt that ride in grooved sheaves. These ridges actually provide twice the contact area of *any other belt drive*. This means more power in less space. And, of course, there is no matching problem, because the Poly-V is a single, molded belt.

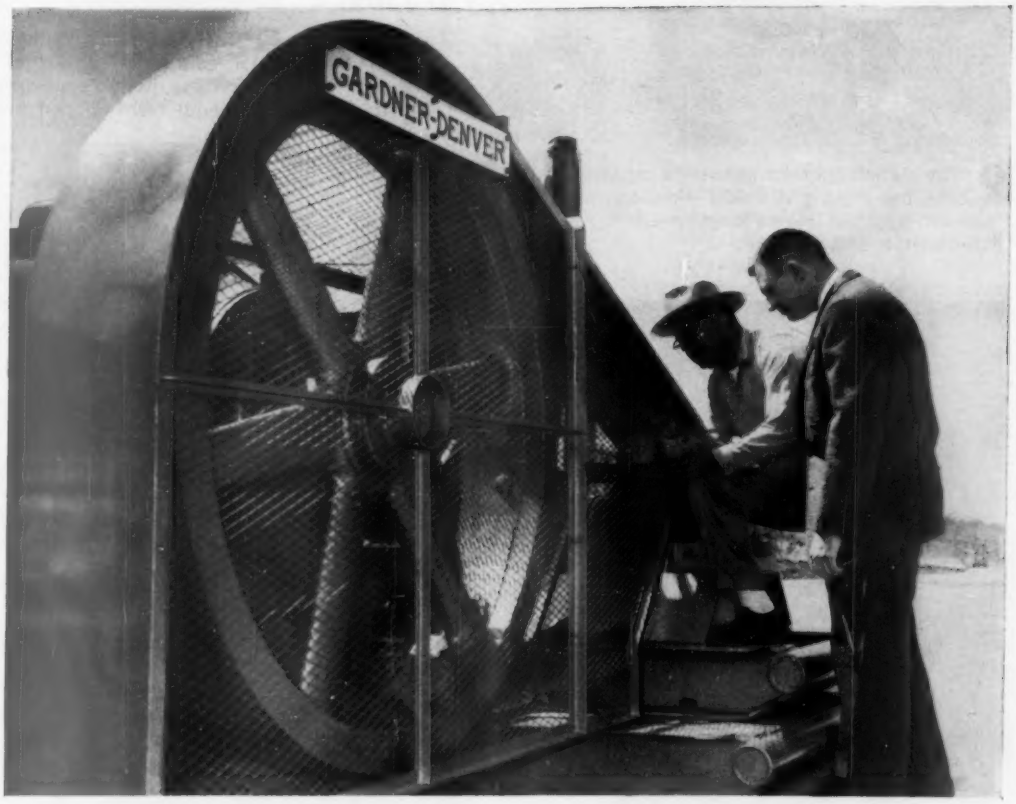
In addition to its superior strength and traction characteristics, the Poly-V can operate at extremely high speeds and flex easily over substandard diameter sheaves. Even tortuous reverse bends have little effect on the Poly-V's long service life.

But you don't have to wait until your next trip to the fields. Find out *now* how the Poly-V can improve the performance of your drives . . . Write today to: ▶

MORE POWER—LESS BULK
wherever greater power delivery is required within critical space limitations, Dayton Poly-V provides the answer with narrower sheaves, shorter centers, more speed ratios and up to 50% more horsepower delivery in ⅓ the space.



GARDNER-DENVER'S powerful natural gas compressor was equipped with the Dayton Poly-V Belt "because of the Poly-V's greater economy in both design and performance over other types of drives tested."



Dayton Industrial Products Co.

Division of Dayco Corporation (formerly Dayton Rubber)

Industrial Department 2001 Janice Ave., Melrose Park, Ill.

Dayco

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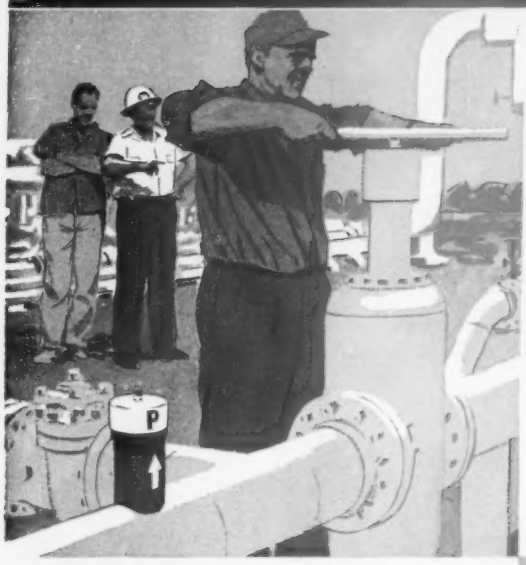
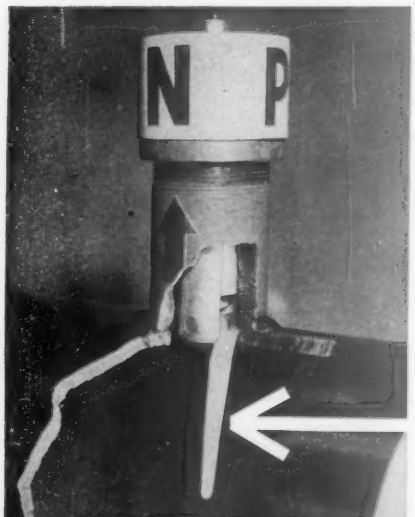
NEWS FROM DOWN THE LINE!



NEW WmSON "PIG-SIG II" CAN BE INSTALLED OR REMOVED UNDER PRESSURE!

❷ "The Pig-Sig II with the Electrical Indicator can signal arrival of pig to pump station operator or start operation of automatic equipment to open and close valves."

❶ "The station operator knows the pig has arrived because the Pig-Sig II visual indicator is in the "passed" position. He no longer needs to wait and listen at the scraper trap."



❹ "This completely new Pig-Sig II uses a standard 2" Thread-O-Ring Nipple. Easily installed under pressure with WmSon Tapping Machines, using a standard drill.
The Pig-Sig II is available with either an electrical or visual signal, extended or regular."

❸ "This new, improved long trigger action detects scrapers even in oversize pipe. Pig-Sig II is excellent for use in metering or calibration."

"Pig-Sig II" Patent applied for

● Write Dept. A for Bulletin A-199

T.D. Williamson, Inc.

P. O. BOX 40 • TULSA 2, OKLAHOMA

REPRESENTATIVES AROUND THE WORLD

▶ ▶ ▶ Equipment Men Notes

William S. Stanley leaves

... the home office of Marsh Instrument Co., Skokie, Ill., to become a sales staff member at the Marsh Cleveland office, handling the company's line of gages, thermometers, and valves. Before joining the Marsh organization early last year, Stanley was with Jackes-Evans Mfg. Co., of St. Louis.

Sam Earnest becomes manager

... of the oil-field-equipment division of Delta Tank Mfg. Co.'s Lafayette, La. branch. A native Texan, Earnest joined Delta in January. He is a veteran of 25 years in petroleum-equipment sales. The Lafayette branch is part of Delta's new direct sales and service program which calls for the establishment of sales and service, as well as stocking points, throughout major oil-producing areas of the United States.

Two sales engineers are named

... by Cooper-Bessemer Corp., Mount Vernon, Ohio, announces George W. Edick, manager of domestic sales.

Don B. Bramley will work under the supervision of Frank J. Hunter, C-B's St. Louis branch manager. Bramley, headquartering at Kansas City, will serve as a specialist in the sale of company gas, diesel, and gas-diesel engines for municipal power plants and other stationary power services in the area.

James C. Dangler will work under the direction of Fletcher M. Devin, vice president and district sales manager of the east-central sales district. Dangler formerly served as assistant to the president of Oster Mfg. Co., Cleveland.

Mid-Continent Supply Co. makes

C. H. Hickman

... C. H. Hickman vice president—area manager of the central operating area with headquarters in Tulsa; L. B. Levell becomes vice president—area manager of the company's southern area locating in Houston; and Robert L. Walters takes over as resident manager in Buenos Aires, replacing Levell.

Hickman, in his 23rd year with Mid-Continent, joined the company in the East Texas oil fields at Turnertown. He has held positions as store manager at Kermit, as district manager at Odessa; division manager at

L. B. Levell

R. L. Walters

Wichita Falls and at Tulsa; and area manager at Tulsa.

Levell will assume his new duties after moving from Buenos Aires, where he had been vice president of Mid-Continent Supply Co. of South America, S.A. A 14-year company veteran, Levell took on his South American job last year. Walters joined the firm in 1952 as a storeman at Great Bend, Kans. He was a representative in Fort Worth for the past 2 years.

ANNUAL SALES MEETING of Stewart & Stevenson Services, Inc., was held in Houston recently. Attending were key sales, engineering, and production personnel from the Houston headquarters, Beaumont, Odessa, Lubbock, Dallas, San Antonio, Corpus Christi, and San Juan. Representatives also attended from New York City and Mexico City. Dealer personnel were also present as were representatives from various supply firms.

Cris Matthews takes over job

... as district representative for Midwestern Pipe Line Products Co., announces John R. Wilson, vice president of the Tulsa firm. Matthews will work out of the Tulsa office and will cover Oklahoma, Arkansas, Northern Louisiana, Western Tennessee, Western Kentucky, Southern Missouri, Southern Kansas, and North Texas.

Prior to joining Midwestern, Matthews was sales manager for Southern Pipe Coating Co. of Atlanta for 3 years. He was also with Barrett Division of Allied Chemical & Dye Corp. for 8 years, and spent 3 years in the corrosion section of Phillips Petroleum.

Plastic Applicators, Inc. names

... C. B. Griggs as head of its division, Pipe Inspectors of Odessa, reports Cordell Garner, vice president in charge of sales. At the same time Garner announced that Herbert Alexander had been named technical consultant for Plastic Applicators.

Griggs, who has had 8 years of oilfield engineering and pipe-inspection experience, joined the company 3 years ago. Formerly he was with Cameron Iron Works. Alexander was with Chemical Process Co., of Breckenridge, Tex., for more than 15 years.

Meanwhile, Charles W. Calhoun has been appointed electronics research engineer, announces H. M. Kellogg, Plastic Applicators executive vice president. Calhoun will be primarily concerned with the development of electronic instrumentation for the firm's Pipe Inspectors Division. He will also work on advanced pipe and coating-inspection devices.

Welex, Inc. appoints two

F. D. Sawyer

... area sales managers and expands two divisions. New Rocky Mountain area sales manager in Denver is F. D. (Buzz) Sawyer, former Rocky Mountain division manager. Former City Salesman J. E. Grady has been promoted to area sales manager in Dallas.

Welex's West Texas-New Mexico division, headed by W. O. Satterwhite in Midland, has been expanded to include the company's Farmington, N. M. station. The Kansas division, under Division Manager Pat Wagstaff at Wichita, has been enlarged

Armour bactericides offer low cost corrosion protection!

Bacterial analysis of untreated water supply, by Armour technical service man, indicates the presence of 27,000 or more sulfate-reducing bacteria per ml. of water. Black coloration of broth medium indicates growth of sulfate-reducing bacteria.

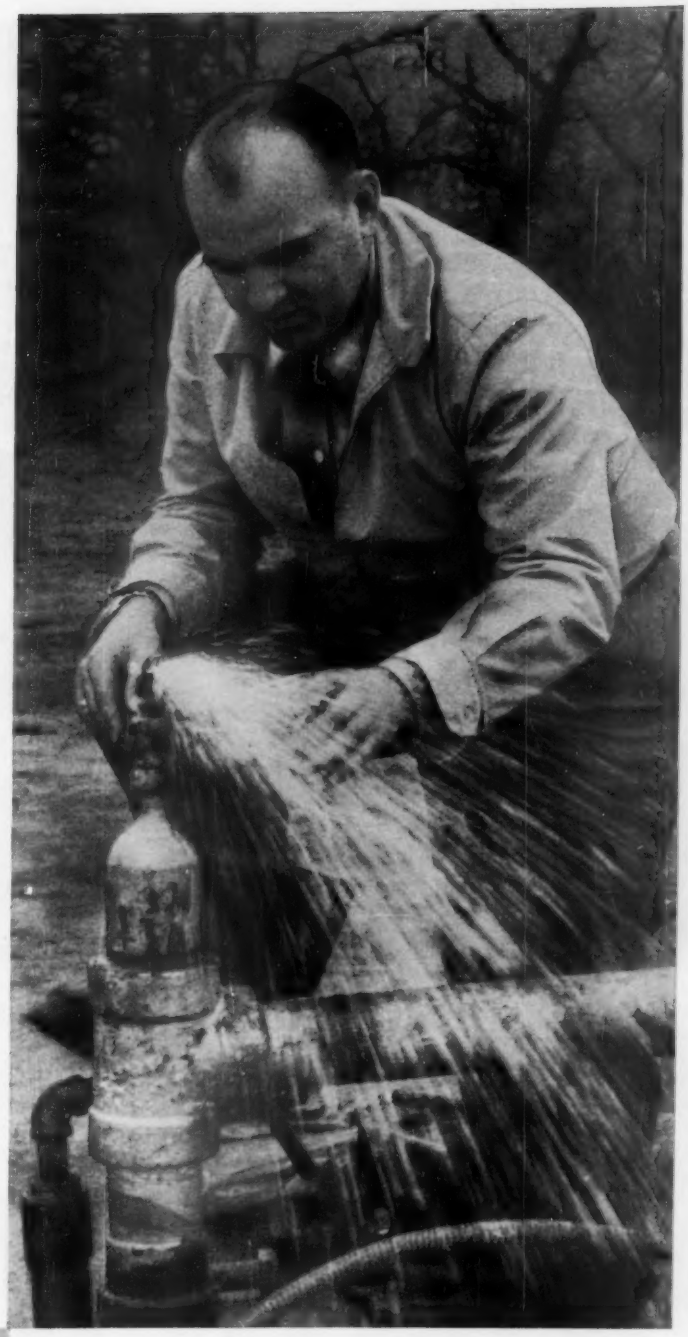
ARMOUR INDUSTRIAL CHEMICAL

Armour's Duomeen® compounds are serving a dual purpose for oil field operators throughout the country. These Armour chemicals not only control bacteria effectively, but reduce corrosion as much as 95% . . . at costs as low as one mil per barrel of treated water.

Using these Armour chemicals, operators realize savings by reducing costly remedial measures such as acidizing, tubing replacements, etc. Further savings are also realized by less down time and lower power costs resulting from lower injection pressures.

Relying on established and industry-approved tests Armour strives to help operators improve and maintain peak production efficiency. These field tests aid Armour's technical service men in making time and money saving recommendations. In the case shown here, Duomeen CD-50 is used for control of sulfate-reducing bacteria in water floods. The small inset pictures illustrate the effectiveness of this Armour chemical.

For complete detailed information on Armour's bactericide-corrosion inhibitors and other chemicals for oil production, write for the booklet, "Armour Organics for Increased Oil Production." Samples of Duomeen CD-50 and other oil production chemicals for your own testing are also available.



Using Armour recommended treatment of Duomeen CD-50, colorless broth medium shown in inset indicates complete control of sulfate-reducing bacteria after 30 days incubation.

COMPANY © *Division of Armour and Company • 110 North Wacker Drive • Chicago 6, Illinois*

Now—automatic dialing all along the line

AE's simple and inexpensive Waystation Dialing System ties your message lines into your automatic exchange *without the need of replacing present equipment.*

The result? Fast, economical dial service throughout your entire telephone network . . . without calls having to pass through dispatchers or switchboard operators. The system provides modern dial telephone service *directly from waystation to waystation, from automatic exchange to waystation, and from waystation to automatic exchange.*

All you need is one inexpensive control unit for each message line to be tied into your automatic exchange, and a simple dial unit—as illustrated—at each local-battery telephone.

For full facts on Waystation Dialing, call your local Automatic Electric sales representative, or write Howard N. Inwood, Director, Railway/Petroleum Industry Sales, Automatic Electric Sales Corporation, Northlake, Illinois.

CHECK THESE FEATURES

- Control Unit and Dial Unit are fully transistorized.
- Dial Unit operates from two 1.5-volt dry cells for dialing ranges up to 60 miles. For longer distances, simply add dry cells.
- Dry cells have long life because battery power is used only when dialing.
- Dial Unit is easily installed; it connects directly to the terminals of any local-battery telephone.
- Dial Unit uses tone signaling — does not upset or interfere with the d-c circuits.
- System permits dialing over existing conversations in cases of emergency.

AUTOMATIC ELECTRIC

Subsidiary of

GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM

to include the company's Kimball, Neb. location.

Other recent promotions announced by Welex include: J. B. Cook, from Odessa sales engineer to Victoria district manager; A. H. Smith, from logging operator to field engineer at Mission; and H. M. Johnson, from senior draftsman to division drafting supervisor at Corpus Christi.

Bud Glenn promoted to manager

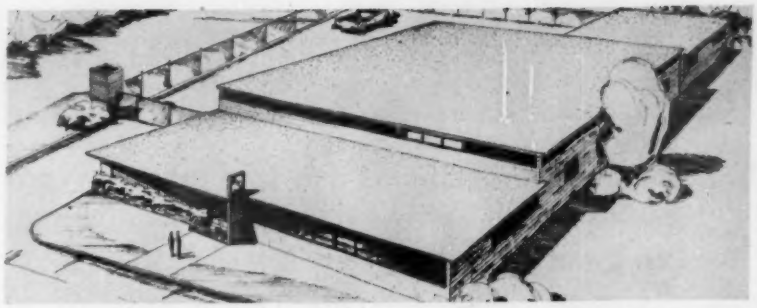
. . . of operations for Crose-Curran, Ltd., in which post he will work out of the main office in Edmonton. Glenn, former branch manager of the Toronto division, will be assisted by Harvey Gordon in the sales department, Bob McLean as office manager, and Bill Clark who heads up the shop and service departments. Other appointments involve: Roger Garneau, office manager of the Toronto division; and Frank Munshaw, in charge of sales and services for the Toronto area.

Oil Well names representatives

. . . at Oklahoma City, Mirando City, Tex., and Brookhaven, Miss. Edward H. Bradley and John W. Coburn assume district-representative posts for Oil Well Supply Division of U. S. Steel Corp. at Oklahoma City. Thomas A. Hopkins becomes sales representative-store area at Mirando City; and Melvin M. Brunet takes over as field representative at Brookhaven.

Bradley, who entered the employ of Oilwell in 1951 at Alice, Tex., subsequently held posts at Healdton and Ardmore, Okla. Coburn, a 21-year division member, moves to his new post from assistant district manager at Oklahoma City.

Hopkins had been district representative of production equipment at Freer, Tex. the past year. Brunet moves to his new job from Eunice, La., where he was a field representative.



NEW HOME of Electrodynamic Instrument Corp. in Houston was occupied recently as the company celebrated its fourth anniversary. EIC had been situated in three separate buildings totaling 8,000 sq. ft. of space. The newly renovated structure will provide more than 17,500 sq. ft.

Procon, Inc. promotes four

James C. Reed has been named executive vice president; Alexander G. Petkus, senior vice president—coordination, engineering, and drafting; James R. Britt, vice president—European operations; and Charles B. Robbins, vice president—staff.

J. C. Reed

A. G. Petkus

J. R. Britt

C. B. Robbins

Reed, former vice president in charge of construction, joined Universal Oil Products Co. (Procon's parent firm) in 1939 and was transferred to Procon in 1950. He was elected a vice president in 1952. Petkus was with UOP from 1937 to 1950, when he became chief coordinating engineer of Procon. He was elected vice president in charge of engineering in 1952.

Britt joined Procon 5 years ago. Prior to becoming general manager of Procon (Great Britain) Ltd. in 1957, he was manager of the company's chemical plants division. Robbins, with Procon since 1951, was general manager of Procon (Great Britain) Ltd. until 1957 when he was appointed assistant to the president.

A. O. Smith Corp. announces

. . . a reorganization of one of its major grouping of divisions and the appointment of three new division managers. The announcement comes from H. F. Detrick, vice president in charge of the Petroleum Group, which now will be known as the Capital Equipment Group. It will include the Tubular Division, the present Process Equipment Division (which has been renamed the Atomic & Process Equipment Division), Aero Western Division, and a wholly owned subsidiary, Glascote Products, Inc. A new Space-Ordnance Division has been created.

New division managers are

NORRIS

Field Tested and Approved

150 psi working pressure

WRITE FOR NEW VALVE BULLETIN
P. O. Box 1739, Tulsa

VALVES

See why ALCOA ALUMINUM makes a good design habit

Requirement: metal pipe and tube to insure corrosion-free fluid handling at low initial cost and minimum upkeep

Key to good design: specify low-cost, trouble-free tubular products of Alcoa Aluminum

The overpowering volume of pipe and tubing needed in the process industries makes it one of the biggest single material investments in most plants. Historically, the repair, maintenance and replacement of piping systems has been too, one of the biggest causes of an alarming increase in maintenance costs. Both factors make vital a clear understanding of the rather remarkable advantages of aluminum pipe and tube.

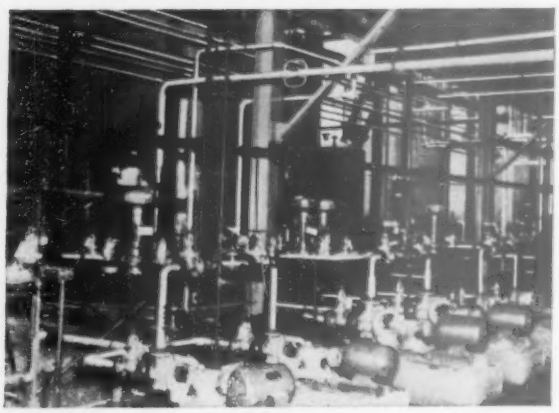
First of all, from a cost standpoint, aluminum is very frequently the lowest cost material suitable for a wide variety of applications in moving fluids through a plant. Consider, for example, the fact that the initial cost of aluminum may often average as much as 50 per cent less than that of admiralty for identical applications. Even greater savings apply when other metals such as stainless or mild steel are compared with aluminum.

Beyond these initial cost savings, aluminum provides significant maintenance benefits. For instance, no other commonly used metal offers aluminum's great resistance to corrosion. And the corrosion resistance for specific alloys exposed to particular environments can be determined from a substantial body of factual service data accumulated by ALCOA over the past 40-odd years.

It is hardly surprising that aluminum, in a variety of tubular forms, is gaining the confidence of more and more designers and builders in the process industries . . . as suggested by the aluminum applications described on these pages. ALCOA's engineers are anxious and willing to share their factual knowledge of aluminum which inspires this confidence. They are doing so through a series of engineering conferences being held this year in major cities around the country. Your local ALCOA sales office will be happy to furnish details.

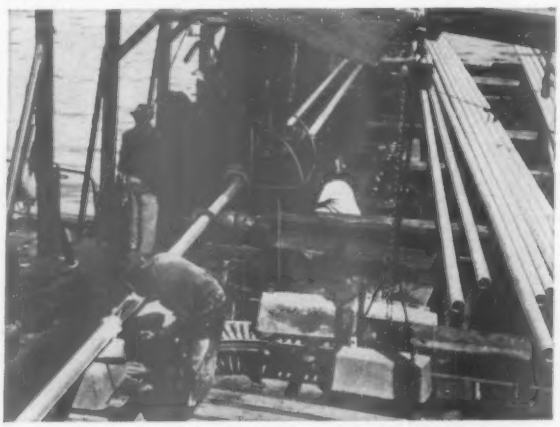
You may also wish to avail yourself of the body of ALCOA literature which describes in technical detail the known performance characteristics of aluminum in a variety of process industries applications. Simply fill in and mail the coupon opposite.

World wide sales through ALCOA INTERNATIONAL, INC., 230 Park Avenue, New York 17, N.Y.



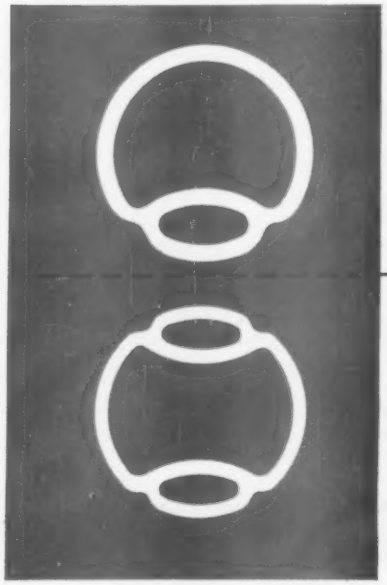
Process piping of Alcoa Aluminum is shown here in a system designed to handle liquid sugar. The natural corrosion resistance of aluminum prevents contamination of the syrup, insures long service life and prevents excessive maintenance. Its scavenging action reduces undesired heavy metal contamination, thereby improving the end product. And aluminum's low friction factor permits fast flow without excessive pumping costs.

This aluminum pipeline is shown being welded and laid in Lake Maracaibo, Venezuela. Aluminum—without special coatings—has proved highly suitable for this operation because it resists so well the corrosive attack of the brackish waters in the lake. Since no coating is required, the low initial cost of the aluminum has proved a significant benefit. The light weight of the aluminum pipe speeded laying operations, and it has no vulnerable coating which would require babying the pipe.



Alcoa Aluminum jacketing keeps the thermal insulation on these large diameter steam lines fully effective. The light, bright aluminum jacketing shields over 5½ miles of piping and insulation from rain, snow, dirt and ice while providing effective protection against a highly corrosive industrial-marine atmosphere.

New UNISTRENGTH pipe by Alcoa now makes it possible to design low-cost welded aluminum lines with uniform bending, bursting and tensile strength throughout their length. The secret is a reduction in wall thickness everywhere but at the ends where it is needed to overcome the local reduction in strength caused by the heat of welding. The result is aluminum piping which weighs up to 40% less but provides equivalent design strength.

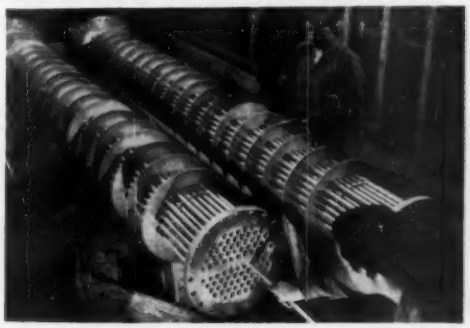


Alcoa UNITRACE is the light, strong, corrosion resistant pipe which provides steam and product passages in a single extruded unit. It has proved an excellent way to cut cost and improve the efficiency of steam traced lines—by eliminating costly external steam jackets or inefficient tracer tubes. Now a new product,

Alcoa DUOTRACE makes possible the same important benefits in steam traced systems where recirculation is desirable. As shown, DUOTRACE provides **two** trace passages plus the product passage in one extruded unit. Flange and Trace Cap fittings compatible with conventional piping are available for both UNITRACE and DUOTRACE.

Design Note: Consider UNITRACE and DUOTRACE as low-cost successors to both heat exchangers and preheaters.

Alcoa Aluminum heat exchanger tubing is frequently the lowest cost material with suitable corrosion resistance for a variety of heat transfer applications. Moreover, aluminum frequently displays significant extra benefits—as in this pair of aluminum oil-to-oil exchanger bundles for preheating vegetable oils. Here, the aluminum alloys have no catalytic effect on the oxidation of the vegetable oil.



ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

For exciting drama watch "ALCOA PRESENTS" every Tuesday, ABC-TV, and "ALCOA THEATRE" alternate Mondays, NBC-TV

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The only units designed and manufactured by burner specialists to eliminate the hazards common to inert gas generating.

MAXIMUM BURNER STABILITY FOR MAXIMUM SAFETY

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WRITE FOR BULLETIN G-59

John Zink COMPANY

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Thomas H. Creden, Tubular Division; Warren Hendrickson, Atomic & Process Equipment Division; and H. D. Barnes, Space-Ordnance Division.

James B. Hill named president

J. B. Hill

. . . of Pacific Mud Co., California affiliate of Magnet Cove Barium Corp. Associated with the supply phase of the oil industry since 1933, Hill succeeds James R. Homan who has been transferred to Magcobar's foreign-operations department.

For 3 years Hill was a sales and service promotion manager for a Los Angeles drilling-mud distributor, and for 4 years headed his own drilling-mud producing and distributing firm in Bakersfield, Calif. His experience includes 14 years with Hughes Tool Co., during which time he served as a sales representative, district manager, and as an exporter of oil-well pipe and chemicals.

Howard S. Gleason becomes

. . . assistant to George A. Peck, president of Southwestern Industrial Electronics Co., a division of Dresser Industries, Inc. Gleason, who goes to SIE from Stromberg-Carlson, served under Peck there as assistant general manager of the Electronics Division.

Glenn Advertising is appointed

. . . as the new advertising agency for Halliburton Oil Well Cementing Co., according to Grover Kilgore, Halliburton vice president in charge of sales and advertising, and Lloyd Lawrence, the Duncan, Okla. company's advertising manager.

Account supervisor for Halliburton will be William J. Alexander, director of the Glenn agency's industrial division, and formerly advertising director for Continental-Emsco Co. He will be assisted by account service personnel in other Glenn offices in Oklahoma City, Houston, Fort Worth, San Antonio, El Paso, Los Angeles, and Ft. Lauderdale, Fla.

Byron Jackson Pumps appoints

. . . F. H. Trones as midwestern regional manager. Trones, who has been with the subsidiary of Borg-Warner Corp. for 20 years, will make his headquarters at BJ's Chicago sales office and will be responsible for sales administration and service in an 11-state area.

For the past 3½ years Trones was district manager at Seattle. Prior to

WHATTA YA' MEAN – SIMPLIFIED?

Welex Develops a New Simplified Logging Program

That's right—Simplified!

The new Simplified Logging Program, available only from Welex, gives fast, accurate answers in more than 90 per cent of today's wells. It cuts costs, confusion and complicated computations to a minimum.

The program is designed to place routine log interpretation and calculations in the hands of the field geologist and engineer. Even for more complex conditions, the Welex program gives the expert log analyst the fastest, most accurate values to use in log interpretation.

Welex's Simplified Logging Program offers two primary advantages:

First: Choice of the RIGHT logging services is made simple—and without risk of running too many logs or too few.

Second: Reading porosity values and other values used in calculating fluid saturation directly off the logs is simplified, making actual determination of these two factors simple and fast.

The new simplified Interpretation Charts or "pigtails" now mean that many wells can be accurately evaluated in minutes after the log is run. To get the values necessary to work the charts, two steps should be followed:

1. Select the proper resistivity log to answer the question—what is the FLUID SATURATION in the zone of interest? Based on salinity contrast between drilling mud and formation water, this choice will be either the Induction Log or Guard Log.

2. Select the proper log to answer the question—what type is the POROSITY in the zone of interest? This choice—either the FoRxo Log or Neutron Log—is based on whether the porosity of the formation is intergranular or fractured or vugular.

Only the two questions listed above — POROSITY and FLUID SATURATION—must be answered to determine if oil or gas is present in the well.

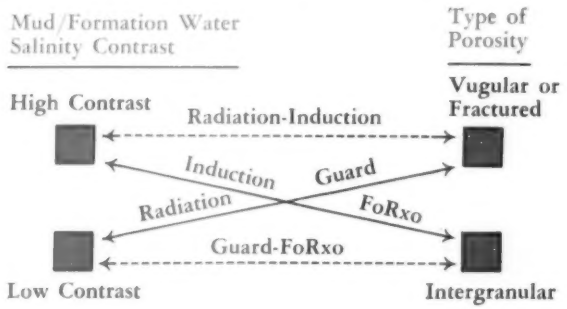
Selection of the Right Logging Service

In order to select the right logging combination for a well, the operator determines two factors:

First, is the salinity contrast high or low?

Basically when the salinity contrast is low, the best choice is the Guard Log. When the contrast is high and for oil base muds and air or gas drilled holes, the best choice is the Induction Log.

Second, what type of porosity is present in the zone of interest—intergranular or fractured and/or vugular?



The FoRxo Log gives the most accurate answer in intergranular formations, while in random fractured or vugular formation or in oil base muds and air or gas drilled holes the Neutron Log is best.

Figure 1 makes the selection simple, based on these two factors.

One of the primary advantages of Welex's Simplified Logging Program is that each of the four logs records the basic measurement with a single curve, making it possible to read the values directly off the log without corrections and computations.

FLUID SATURATION--INDUCTION OR GUARD?

Determination of the FLUID SATURATION in the well is based on the values read directly off the Induction Log or Guard Log. Selection of the correct log is based on the salinity contrast between drilling mud and formation water. This easily understood concept is best described and measured in terms of a resistivity ratio.

Accurate determination of this ratio, which can be obtained from known data in the area or from the SP, is very important. Designated as the Rmf/Rw ratio (resistivity of mud filtrate/resistivity of formation water), this contrast governs the choice of the logging tool to determine the formation's true resistivity (Rt) because it controls the Rxo/Ro ratio (resistivity of the first few inches completely flushed by mud filtrate/resistivity of the formation completely saturated with formation water.

Generally, the Guard tool is affected mostly by higher resistivity, either invaded zone or Rt; and the Induction tool is affected mostly by lower resistivity, whether invaded zone or Rt. Each tool records resistivity values with a single curve.

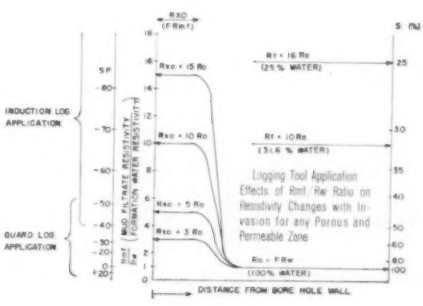
Figure 2 shows the area of application of each of these two tools, depending on the Rmf/Rw ratios (SP values may be used as an alternate method of making this determination).

The Guard Log is more accurate in the area where the static SP is 50 to 55 millivolts or less (negative deflection from the shale base line) which is an Rmf/Rw ratio of 6 or less. Under this condition Rxo (flushed zone) will be six times Ro (the uninvaded zone if it contained formation water only) or less, but Rxo still is less than Rt for a zone containing producible hydrocarbons.

The Induction Log application is in the area where the static SP is greater than 40 millivolts (negative deflection) which is an Rmf/Rw ratio of 4 or more. Whenever this ratio

← Figure 1

Figure 2 →


INDUCTION LOG APPLICATION
GUARD LOG APPLICATION
Rxo + 15 Ro
Rxo + 10 Ro
Rxo + 5 Ro
Rxo + 3 Ro
Rt = 16 Ro
(25 % WATER)
Rt = 10 Ro
(31.6 % WATER)
Ro = FRw
(100% WATER)
Logging Tool Application
Effects of Rmf /Rw Ratio on Resistivity Changes with Invasion for any Porous and Permeable Zone
DISTANCE FROM BORE HOLE WALL

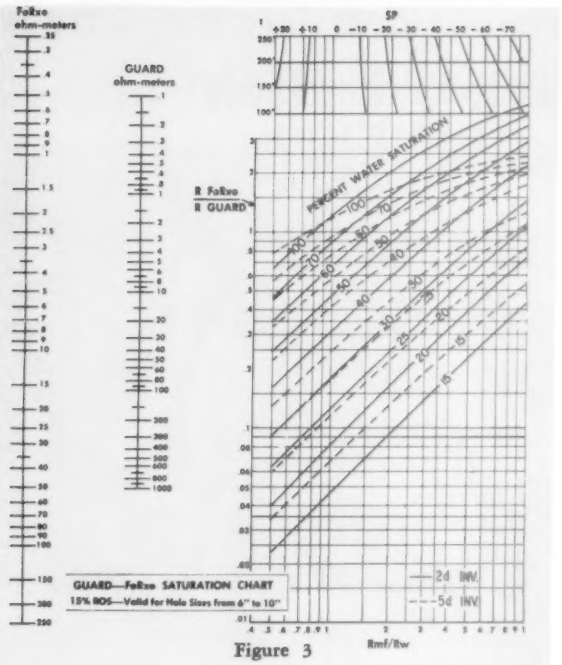


Figure 3

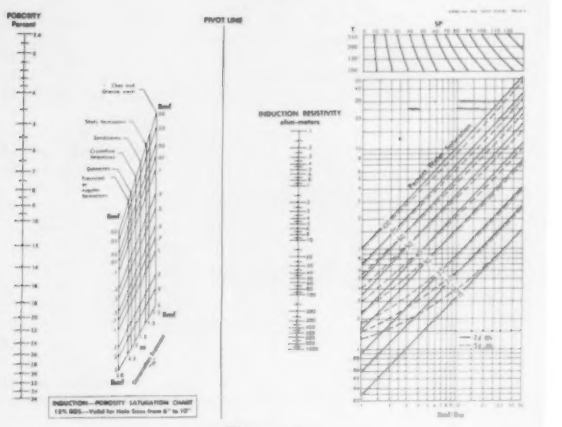


Figure 4

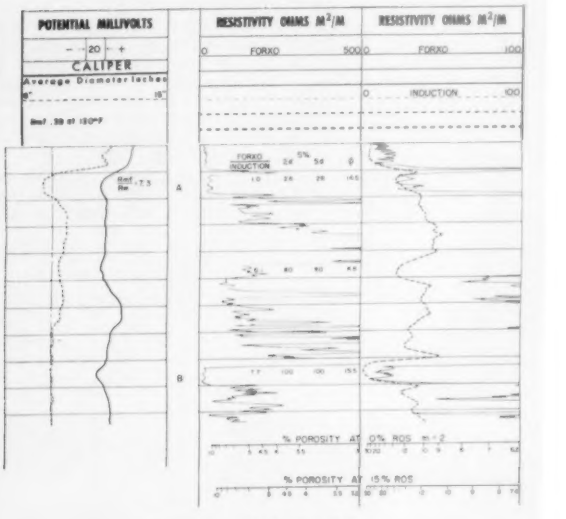


Figure 5 **Induction-FoRxo**

is 4 or more, Rxo is sufficiently greater than Ro so that the effect of normal invasion on the Induction tool is negligible in water sands. However, Rxo still is close enough to Rt for a producing zone so that again there is little effect from normal invasion.

The effect of bed thickness is over and above the previous discussion. The Guard Log will give accurate values in zones 1½′ thick or greater, while the Induction Log will give accurate values in zones 3′ thick or greater if adjacent beds have a greater resistivity than the zone of interest. If the adjacent beds have less resistivity, the Induction Log will give accurate values in zones 5½′ thick or greater.

POROSITY DETERMINATION--FoRxo OR NEUTRON?

The type of porosity present usually can be answered from the geological knowledge of the area. It will be either intergranular, such as sandstone or crystalline limestone; or it will be fractured and/or vugular. Generally the FoRxo Log is the best choice in intergranular formations, while the Neutron Log should be used for fractured and/or vugular types. For oil base muds and air or gas drilled holes the Neutron and Induction Logs should always be used since direct resistivity measurements cannot be made under such hole conditions.

As with the resistivity logs, both the FoRxo and Neutron Logs record a single curve, permitting porosity values to be read directly off the log using the Porosity Scale on the log.

In some formations, there will be an overlapping of the two porosity logs, with both giving good porosity values. In these cases, the FoRxo Log generally is the best choice since it measures in terms of resistivity and can be compared directly to the Induction or Guard log.

Saturation Calculations

Figures 3 and 4 are examples of the simplified saturation charts used for calculation and printed on the end of the log.

The nomograph on the left of Figure 3 is used to give the ratio of FoRxo to the Guard reading (Induction reading on the Induction-FoRxo chart), and this value at the proper Rmf-Rw value gives water saturation. Measured Rw values from data in the area should be used if possible, but the SP scale is provided at the top of the chart for use as an alternate method.

Figure 4 is the chart printed at the end of the log where the Neutron Log has been used to give porosity.

In this case the porosity value measured by the Neutron Log and the Induction value (Guard value on the Radiation-Guard chart) are used to gain entry into the Water Saturation section of the chart. This value at the proper Rmf-Rw value gives water saturation. On this chart the SP scale is also provided for use if necessary.

In both types of charts, as shown in figures 3 and 4, the solid lines in the water saturation section are for 2d invasion and the dashed lines are for 5d invasion.

Induction-FoRxo

Figure 5 is an example of an Induction-FoRxo Log in the Morrow Pennsylvanian of the Panhandle. With the Rmf/Rw ratio of 7.3, Rxo and Rt would be approximately equal in an oil zone as shown by Figure 2. In Zone A the Induction resistivity and lower FoRxo values coincide, showing that Rxo=Rt= —22 Ohms, giving 28 per cent water saturation. Zone B is shown to be quite variable porosity by FoRxo with a considerably lower induction resistivity value, so that the ratio is the same as the Rmf/Rw ratio. This indicates 100 per cent water.

Guard-FoRxo

Figure 6 is a Guard-Fo-Rxo Log in the Gulf Coast Wilcox. With the Rmf/Rw ratio of 1.15, the Guard/FoRxo ratios of .35 to .6 over the upper section give low water saturation calculations. In the lower sand stringers the higher Guard/FoRxo ratios give higher water saturation values which would be in-

terpreted as transition to water. As shown by all curves, the sands are very broken with numerous thin shale streaks and hard streaks. The detail afforded by this combination allows saturation determinations under very adverse conditions. Over the upper section all of the sections showing curvature on the SP, indicating porosity, have Guard readings higher than FoRxo. As a result net pay can be easily determined.

Radiation-Induction

Figure 7 shows the application of the Radiation-Induction Log in water base muds with Rmf/Rw ratio of 8 in the Strawn Lime in Andrews County, Texas. The upper zone calculations indicate water production as verified by drill stem test. The lower zone calculations are also in accordance with test and completion results. At 10,908′ the calculation of 55% water in the 5% porosity is as would be expected. The lower porosity would have a higher water saturation because of capillary effects. From 10,920′ to 10,930′ the calculated water saturation is considerably lower in the higher porosity. However, below 10,950′ the calculated water saturations are high again but in relatively good porosity, indicating a possible transition zone from oil to water.

Radiation-Guard

Figure 8 shows the Radiation-Guard Log over the Arbuckle section of Russell County, Kansas, drilled with a low resistivity mud—Rmf/Rw of 1. This well is a field development well and the Guard was run in the open hole and the radioactivity Log was run after casing was set. This results in saving rig time on development wells, but still gives complete information as on the initial wells in the field. In this case the pipe was bailed dry before the R/A Log was run. Detailed saturation calculations are tabulated on the log along with porosity values from the scale at the bottom of the log. Also shown are the open hole tests and completion information.

Summary

Use of Welex's Simplified Logging Program allows saturation and porosity determinations quickly and easily. The principles upon which the approach are based are not new, but the presentation of the method shows the logic and reason of log interpretation without laborious calculations from equations which at times obscure the effect of the various factors involved. This presentation also shows the log curves in such a manner that the effects of bed thickness, interbedding, shaliness, etc., can be taken into consideration by the user with reliable results. In addition the Saturation Charts or "pigtails" are presented so that all of the variables are shown on the applicable chart, and the effects of the variations on the calculated saturations can be easily determined.

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In Canada: Welex of Canada, Ltd.

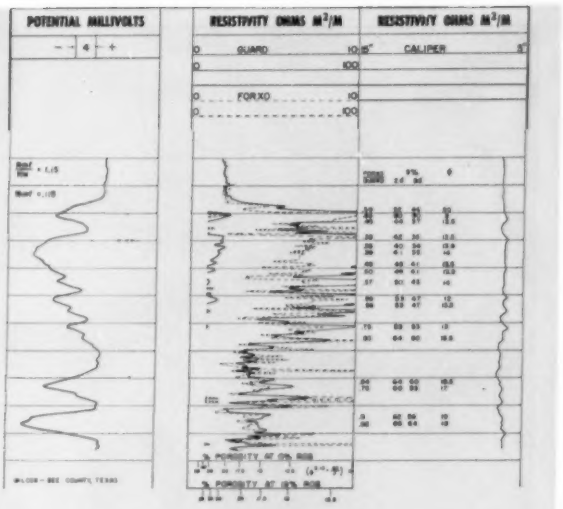


Figure 6 **Guard-Fo-Rxo**

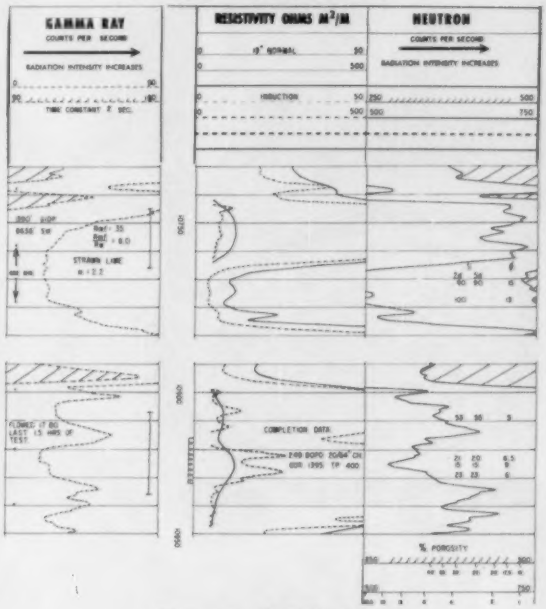


Figure 7 **Radiation-Induction**

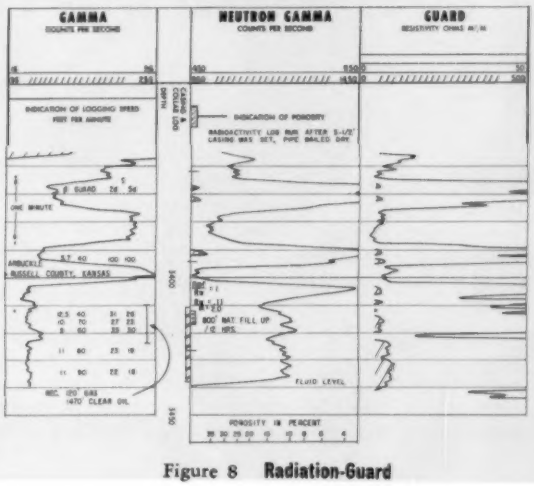
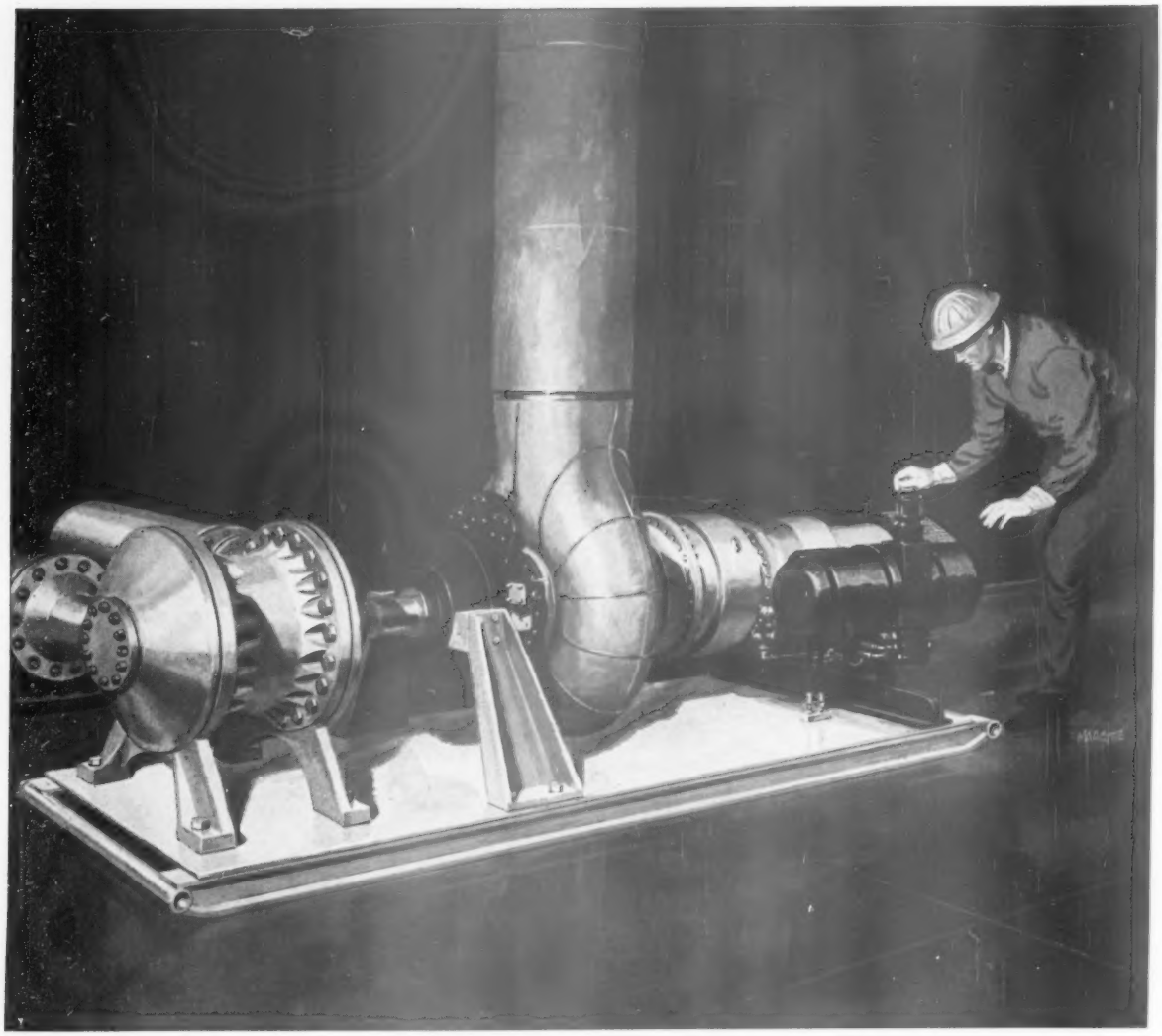


Figure 8 **Radiation-Guard**



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Solar industrial gas turbine-driven centrifugal compressor offers advantages found in no other type

SOLAR'S LIGHTWEIGHT centrifugal compressors incorporate unique new features for applications in the low-volume range. They operate in a range of flows and pressures new to centrifugal equipment. Interchangeable compressor wheels and other parts permit quick, low-cost field changes to accommodate new flow and pressure requirements. Ideal for main pipeline stations as well as field use, they can be started or shut down in seconds—even by remote control—and are ideal for unattended operation.

Designed to match the high rotating speeds of Solar gas turbine drivers, Solar's new compressor packages are small and lightweight (a fraction of the weight of conventional piston-driven units). They require only the lightest foundations. Maintenance is simple. Easy portability allows periodic inspection at a central shop.

A new illustrated brochure describes in detail Solar centrifugal gas compressors. Write for it to Dept. H-115, Solar Aircraft Company, San Diego 12, California.

SOLAR
AIRCRAFT COMPANY

this assignment he was a design and sales engineer for more than 16 years in the company's general offices in Los Angeles.

Goff named sales representative

. . . for the store area at Harmony, Ind. by U. S. Steel's Oil Well Supply Division, reports J. P. O'Toole, the division's eastern area manager. After being employed by Oilwell in 1938 at Centralia, Ill., James E. Goff was transferred to Olney, Ill. and then to Chicago.

Following military service, Goff was employed at Olney in 1946. He transferred to Salem, Ill. the next year and back to Centralia in 1951 where he became store manager. Two years later Goff was transferred back to Salem and appointed field representative, holding this position until now.

Harold Harkrider is appointed

. . . technical consultant for cement linings in the Midland, Tex. area of Plastic Applicators, Inc., reports Cordell Garner, vice president in charge of sales. Harkrider was transferred to Midland from Hobbs, N. M., the branch he headed for the past year.

National Supply Co. opens

. . . an oil-field-supply store at Jonesville, Mich., and names Robert L. Smith manager of the new store. The facility is under the jurisdiction of James A. Gilkey, Jr., assistant district manager at Mt. Pleasant, Mich.

Coates Field Service, Inc. given

. . . a dominion charter in Canada, under the name of Coates Field Service (Canada) Ltd., with temporary offices located in Toronto. Coates is now authorized to do business in all of the 10 provinces of Canada.

Ajax Iron Works announces

. . . the appointment of Mid-Continent Supply Co. as distributor for Ajax pumps, compressors, and engines used as prime movers for pumps and compressors. National Supply Co. and Bethlehem Steel Co.'s Supply Division will continue to handle Ajax pumps, engines, compressors, and well-pumping-unit engines.

Marcel L. Valois takes over

. . . as industrial sales representative in the Baton Rouge area for Napko Corp., Houston industrial coatings and paint-manufacturing firm. Valois' experience has been primarily in the paint and coatings field, principally in the Southern Louisiana area. Prior to

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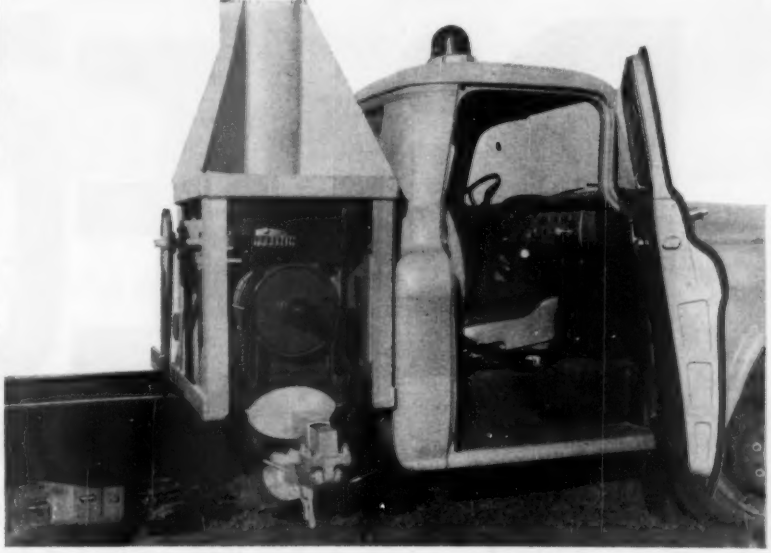
Special Applications

A special BRADEN Winch can be specially designed for practically any handling or lifting job you need!

Pictured here is a special adaption of standard BRADEN Models MS6, MS9 or MS10, for Mi-Jack Products, Inc. This special winch application is used to operate a versatile revolving boom mounted back of the cab on the right side of the truck.

The boom is being used successfully for line construction and other contracting work, and can operate hole-digging equipment, pull well tubing and many other exacting jobs that require dependable winches that can keep load under perfect control.

A BRADEN engineer will be happy to consult with you on any special handling job, or show you how standard models can be adapted for special work. Write for complete information.



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joining Napko last November, he was factory representative in the Gulf Coast area for a firm specializing in coatings.

Tex-Tube appoints Jack Haden

. . . assistant sales manager. Haden joined Metal Goods Corp. in 1945 and later served with Southwest Fabricating & Welding Co. After starting with Tex-Tube in 1950, he served on the company's sales desk for 4 years. He then became outside salesman.

Milwhite Mud Sales Co. names

. . . Joe Bob Gale sales representative for the Tulsa area and transfers William T. (Bill) Wall to Shreveport where he will continue in a sales capacity.

Gale was employed by Fleet Drilling Co. before joining Milwhite. Wall began with the firm in 1952 as mud engineer, working in Alice and Beaumont. In 1956 he was transferred to Houston as district supervisor, and last year was sent to Midland as division engineer.

O. F. Henning assumes position

. . . as marketing manager for Texas Instruments, Inc.'s Geosciences & Instrumentation Division's instrumentation product group at Houston. He joined TI in 1955.

Henning formerly was a regional sales manager with International Register Co. for 4 years. Prior to that he spent 5 years with Minneapolis-Honeywell as an instrumentation sales engineer.

Baash-Ross Division appoints

. . . Earl Barkley area sales manager of the newly formed Rocky Mountain area offices and transfers F. L. Waller to Houston as district sales representative, reports R. A. Forsman, director of sales and service.

From offices in Denver, Barkley will supervise sales activities in the area, including district offices in Casper and Farmington, which have become part of the new area. Barkley was previously in charge of the Baash-Ross office covering the Dallas-Fort Worth district. Prior to joining Baash-Ross, he was a sales engineer with Joy Mfg. Co.'s Oilfield Division.

Waller joined the division in 1945. Before transferring to Houston he was operations manager of the Odessa plant.

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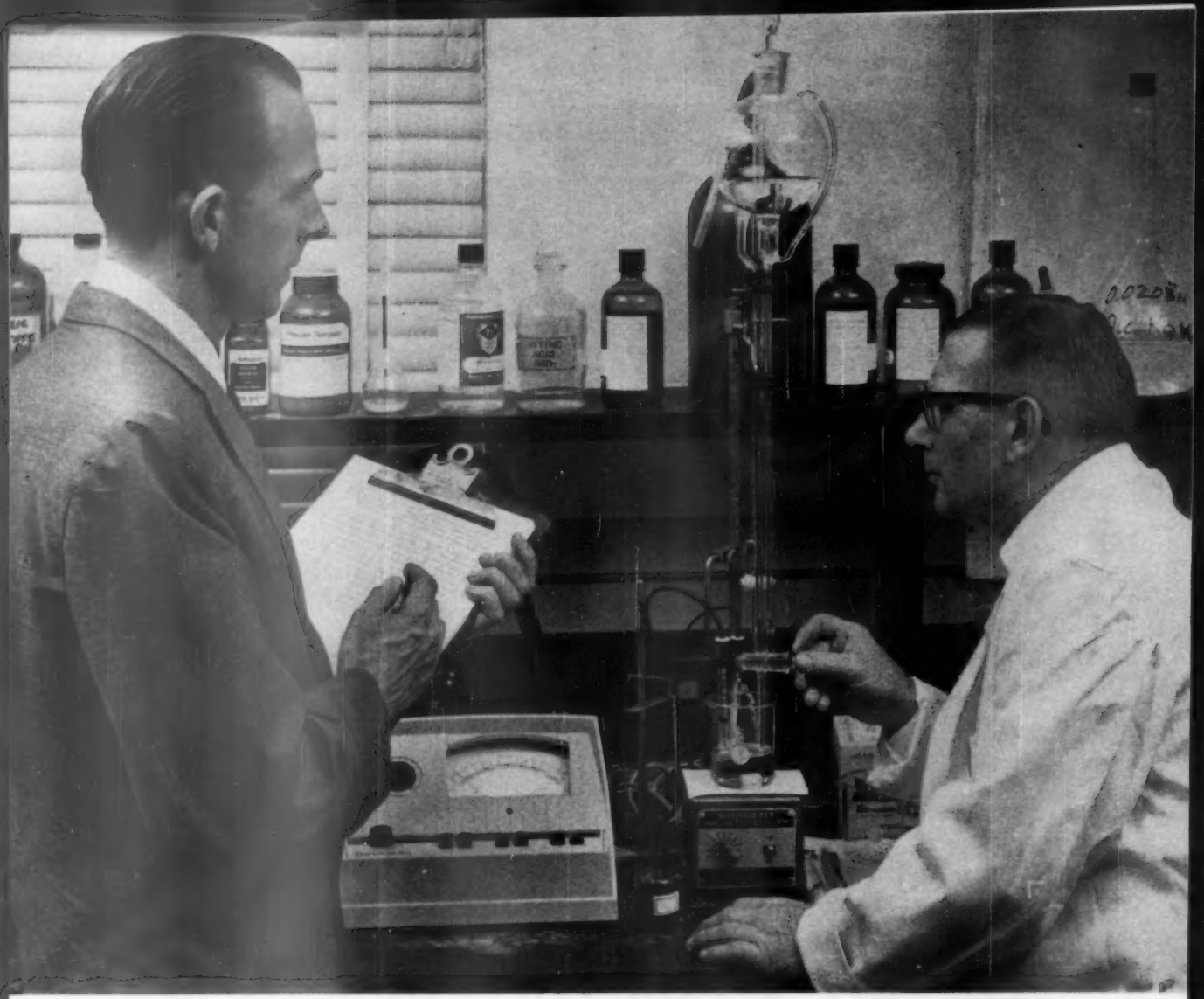

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Specific analyses of amine solutions are often needed to pinpoint gas sweetening difficulties. After studying your problem, Jefferson's Gas Processing Specialist will know which analyses to recommend. Frequently, he will request samples to be sent to Jefferson's Austin Laboratories, where analytical equipment and specialized experience, not ordinarily found in plant laboratories, are available.

Let's say your sample is a lean diethanolamine solution and he needs to know such factors as: DEA from alkalinity before and after ion exchange; DEA calculated from Kjeldahl test for total nitrogen; analysis of other nitrogenous materials such as ammonia, thiocyanate, etc.; determination of heat stable salts present; viscosity; alkali metals; iron and iron capacity. Jefferson's Gas Processing Specialist requests and coordinates these tests. His detailed interpretations of the results are correlated with information on your specific operating conditions. Successful remedies to your problem most likely follow.

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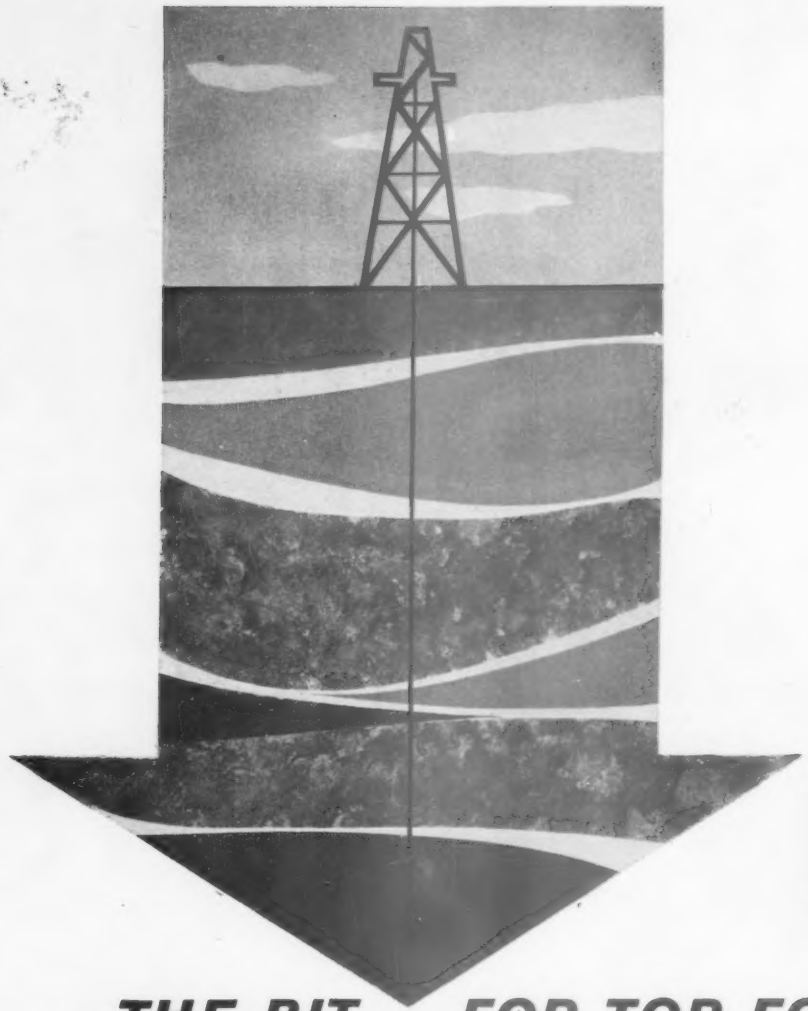

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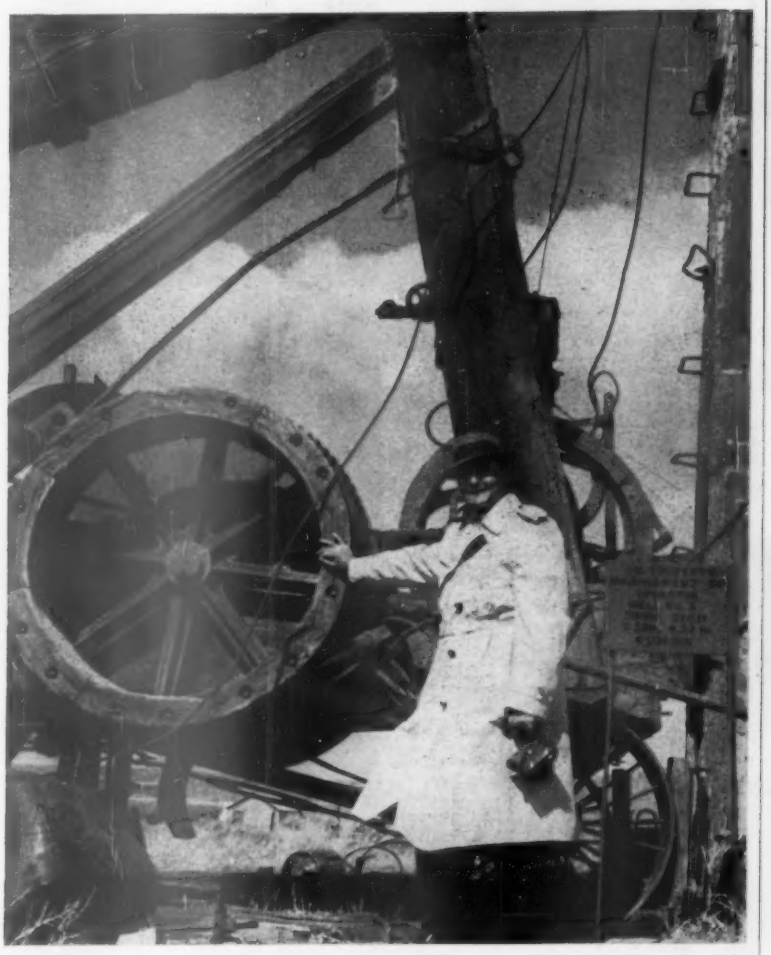

THIS OLD Star cable-tool rig has been shipped to the Smithsonian Institution in Washington, D. C. The donor, Walter G. Davis, a Casper oil operator, gives it a last look before it is loaded aboard train.

Old rig moves to Smithsonian

"IT TAKES time for appreciation" might be the thought behind an old Star rig that made news recently.

Although the relic hasn't turned a tap since 1920, it's slated to rest in posterity in the new Petroleum Wing of the Smithsonian Institution. It's a long, long way from Wyoming to Washington and the final trip was made possible through the efforts of Walter G. Davis, Casper oil man, who had the old tool loaded on one of the Burlington's flat cars.

The Star cable-tool drilling rig was once the pride of the Iron Creek field west of Casper. Its vintage is around 1890 and this type of equipment was popular in Wyoming oil fields during the bustling early days. It drilled holes from 800 to 1,200 ft. in the promising Iron Creek field which was discovered in 1917.

Cable-tool rigs like these, with all the accessories intact, are fast becoming rare. Davis also included in his gift to the museum a steam boiler, a set of bits (still unused), and a complete set of component parts necessary to make the unit run. It will be set up where visitors to the nation's capital can see it operate.

At the same time, Davis gave another Star rig to the Central Wyoming Fair Board to be set up in a picturesque "oil boom town" which is planned for the fairgrounds. The directors, who were only mildly interested when the gift was first proffered,

SPECIFY 500 TON for LONGER THREAD LIFE!

Protects more tool joint threads than any other compound!

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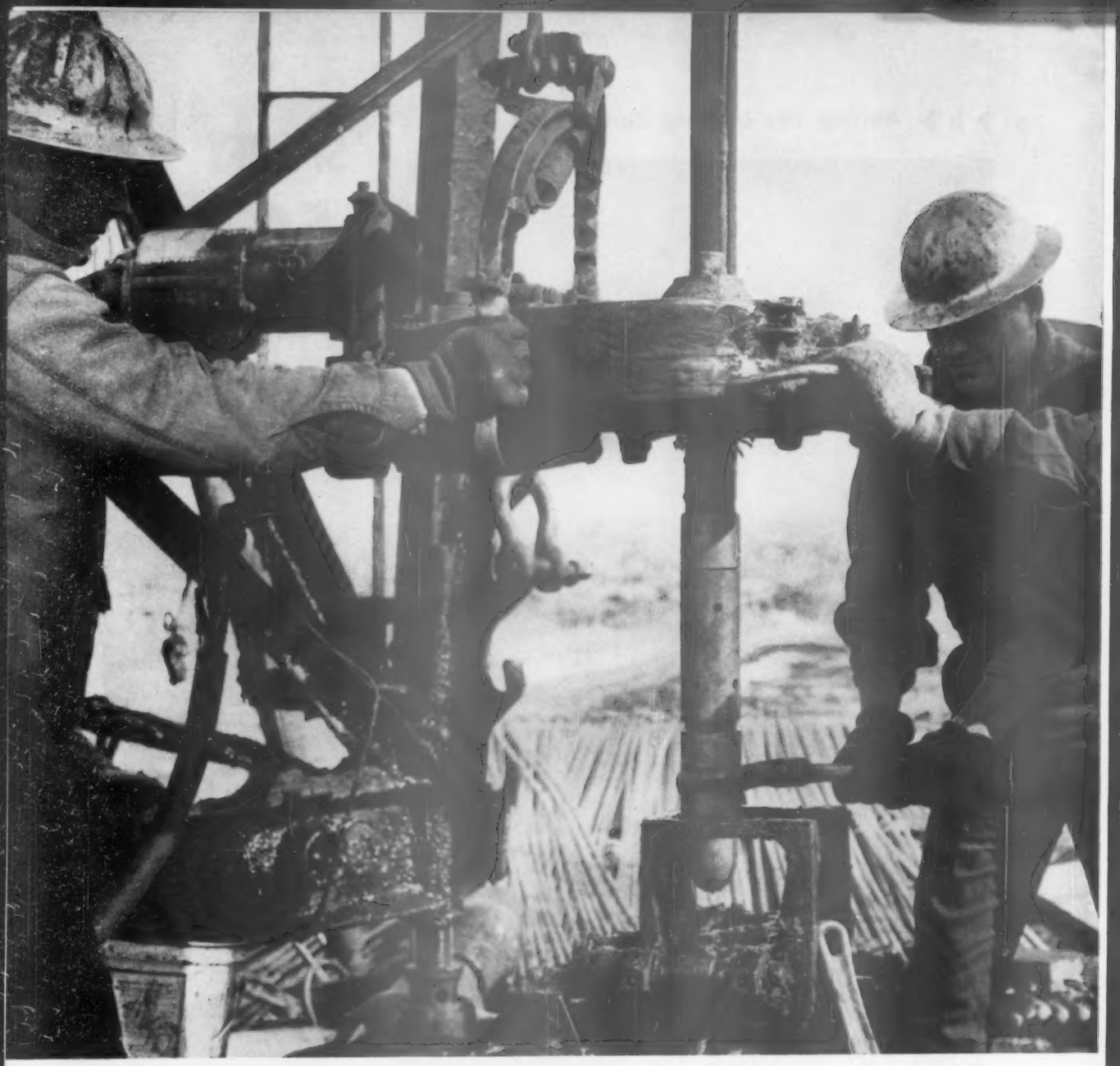

ABRASIJET--A NEW KIND OF SERVICE THAT HELPS YOU

MAKE POOR WELLS GOOD AND GOOD WELLS BETTER

Abrasijet* is a new Dowell-developed formation cleaning and perforating service. It uses high-velocity streams of fluid and abrasive particles, usually sand (pumped through small jet orifices in the tool pictured above) to perforate casing or cut through well bore damage. Water, oil, acid and mud have been used as the sand-carrying fluid.

Reports from field after field show that Abrasijet gives better results than more conventional treatments in many instances. These same reports also show that Abrasijet has been successful in cases where all other treatments failed. Here are a few examples:

IN SOUTH TEXAS. Abrasijet was used to re-perforate a Wilcox well and penetrate beyond gyp deposited near the well bore. Production had dropped to 10 bopd on gas lift. Five sets of two perforations per level were jetted using Dowell inhibited acid and sand. *Production rose to 96 bopd with 880 psi flowing pressure.*

IN NORTHWESTERN NEW MEXICO. *Abrasijet was used to complete a 260 bopd flowing well in an area surrounded by dry holes.* Completion was into a 22-foot section of the Dakota. Abrasijet was employed to make 48 perforations in twelve settings of a four-jet tool. Well was also fractured in the basic eight-hour pump-rental time.

NEW IDEAS FROM DOWELL

TO HELP YOU MAKE MORE PROFIT

"ACID GUIDE"*

This new companion to the "Frac Guide"* is used by Dowell for *better* engineering of acid treatments. Results have been greater production increases, lower treatment costs, or both. Probable results of acid treatments can be predicted, and the most promising treatment selected for a given well.

CORROSION INHIBITOR SQUEEZE

This Dowell-developed technique for inhibiting corrosion in oil wells has given excellent long-term protection with minimum cost of application. Second and later applications of Corban* inhibitor by "squeezing" it into the producing formation have been even more efficient than the first.

FOAMING AGENT FOR WATER REMOVAL

This new Dowell addition agent can be added to water used in fracturing to induce foaming and reduce swabbing time. It is also used to facilitate air or gas drilling through low-production water zones. For air drilling, it minimizes "balling" of cuttings and creates a foam for easier water removal.

IN SASKATCHEWAN, CANADA. *A well was successfully perforated with Abrasijet after two attempts at explosive perforating had failed.* 4½-inch casing had been cemented through the Mississippian pay from 2318 to 2323 feet. Four perforations were made followed by a frac job. *One month later production was averaging 70 to 80 bopd in a field where most wells average only 50 to 60 bopd.*

IN CENTRAL KANSAS. *A well that produced only water on initial completion was recompleted successfully with Abrasijet.* A radioactive survey showed a channel from initial perforations at about 3318 feet to bottom of casing at 3405 feet. Well was squeezed with cement to shut off water. Abrasijet was used to reperforate without shattering cement. New perforations were from 3323 to 3329 feet. *After acidizing, well tested 6.5 boph with only a trace of water.*

The chances are good that you can increase your profits with Abrasijet. For prompt service or detailed information on Abrasijet, *dial Dowell.* There are 150 offices and stations in the United States, Canada, Argentina and Venezuela. Dowell, Tulsa 1, Oklahoma.

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DIVISION OF THE DOW CHEMICAL COMPANY

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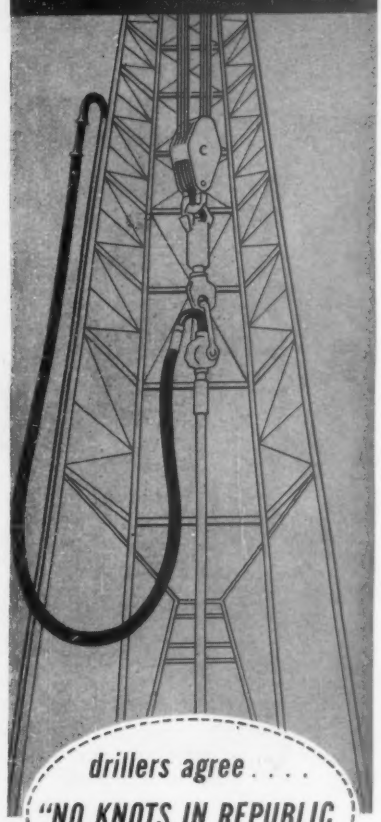

drillers agree . . . .
"NO KNOTS IN REPUBLIC HOSE!"

Equal tension on each steel cable prevents knots.

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For information on Rotary, Mud Pump Suction or Vibrator Hose, write to: Republic at Youngstown or check your local J & L Supply Store.

accepted enthusiastically when they found out that the Smithsonian was keenly interested.

Davis apparently has a flair for realizing value in things normally considered outmoded. The entire Iron Creek field almost was abandoned for junk 5 years ago when he bought it. Production had dropped to an ebb so low that it was deemed uncommercial for the major oil firm that operated it.

Bought at salvage prices, the wells were cleaned out and were produced at a modest profit. It was the type of operation that an independent could work efficiently, but almost impossible for a large firm to break even on. Davis readily admits it was strictly a "poor boy operation."

The setup was an ingenious combination of homemade separators to remove the water from the crude, a treating plant, and small, compact electric pumping units. The revamped equipment and diligent cost-cutting methods resulted in a small production sufficient to pay the wages of the lease foreman, Bill Doran, and make a small return on the investment.

Five wells are still producing 30° oil which is hauled by truck four times a year to the Mobil Oil Co. refinery in Casper. An old gas well, which once supplied gas to Casper, still yields enough gas to run the treating plant and provides gas to heat the home of Mr. and Mrs. Doran on the lease.

Doran is the lease foreman, chief pumper, treater operator, and everything else that goes with the running of an oil field. This is strictly a one-man field. Davis says he will continue producing the field as long as it pays expenses.

Test to offset old show

AN OLD MEMORY may be the clue to new oil for this California effort. Universal Consolidated Oil Co. will drill a wildcat in the West Comanche Point area 8 miles south of Arvin. The firm is seeking a middle Miocene sand that showed promise in a well drilled by Richfield Oil Corp. 15 years ago.

The 5,500-ft. test is the 81-36 Evans in NE corner of 36-12n-19w, Kern County. The site is 2 miles west of production at Comanche Point and ½ mile north and slightly east of Richfield's 1945 venture. The latter redrilled and set casing but was unable to achieve commercial oil. Hagestad Drilling Co. of Bakersfield is the contractor.

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10-K Natural gold set with 2 pt. diamond $22.50

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"Duster" Legend designed in 10-K natural gold. $6.50

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New Servco Reamer-Stabilizer keeps hole to gauge through 4,000′ of hard Moenkoepi and Coconino sands

Not a single instance of out-of-gauge hole trouble over the full 7526′ depth.

The Camay Drilling Co. Levan Unit No. 1 (Sec. 17-15S-1E, Juab County, Utah) was drilled through 7526′ of the hardest, sharpest sand ever drilled in the Rockies. Below 3500′ the bit was constantly in Moenkoepi and Coconino formations. However, there was not a single instance of out-of-gauge hole trouble, although many of the bits came out of the hole considerably under their original diameter. Prior to the use of this new tool, it was necessary to use a new bit to bring the hole back to gauge for every bit used to drill the formation.

This remarkable success on the Camay job was due to a revolutionary new Servco Reamer-Stabilizer* positioned just above the bit. This rugged tool consists of a replaceable, keyed sleeve which locks into position on a mandrel. The gauge section of the sleeve is faced with ⅜" of Servcoloy "W," an amazing new tungsten carbide dressing material developed by Servco for use in applications where severe abrasion is encountered. Both key and sleeve can easily be changed at the rig by the crew. If necessary, the sleeve is easily washed over.

You can get complete information on this newest Servco development by calling your nearest Servco office.

PROVED EXCEPTIONALLY SUCCESSFUL IN THE FOLLOWING OUT-OF-GAUGE AREAS

Areas	Formations	Location
Trail Unit	Mesa Verde	Southwest Wyoming
Chicken Springs	Mesa Verde	Southwest Wyoming
Levan Unit	Moenkoepi and Coconino	Juab County, Utah
Coral Sand Dunes	Coconino and Lakota	Kane County, Utah
Temple Springs	Coconino – others	Green River, Utah
Starr Flat	Coconino – Tensleep	Duchesne County, Utah
Rangely Field	Weber – below the Weber	Rio Blanco County, Colorado

Company and names of field personnel furnished on request. Please write the Casper office.

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Century Electric 25 hp motor driving unit pumper in Harris County oil field.

Why Century Electric motors help cut oil field operating costs

Here's why a Century Electric motor was selected to drive this Texas oil field unit pumper—

DEPENDABLE POWER. All Century oil field motors have these long-life features:

Rotor receives special balancing test before shipment . . . makes it smooth running and assures long bearing life.

Windings are insulated with tough polyvinyl acetal insulation which has great mechanical and dielectric strength.

Special stator insulation system includes several coats of high-temperature phenol-formaldehyde baking varnish . . . result gives protection against oil fumes, alkalis, dust and dirt.

Cast iron or steel frames are designed to withstand demands of the toughest installation.

Dripproof enclosure protects motor against rain, snow, dust and dirt. Rodent screens for dripproof motors prevent service interruptions at isolated installations. Totally enclosed motors are also available.

APPLICATION AID. Century Electric application engineers can help you get the right motor for your drilling, production pipe line or refining job from the 10,000 types Century makes. For instance, on the unit pumper shown above, one problem was to supply high starting effort. The Century Electric SCH motor with at least 200% starting torque does the job. Result: dependable motor power and lower operating costs. For more information contact your nearest Century Electric sales office or your supply store. For more than a motor . . .

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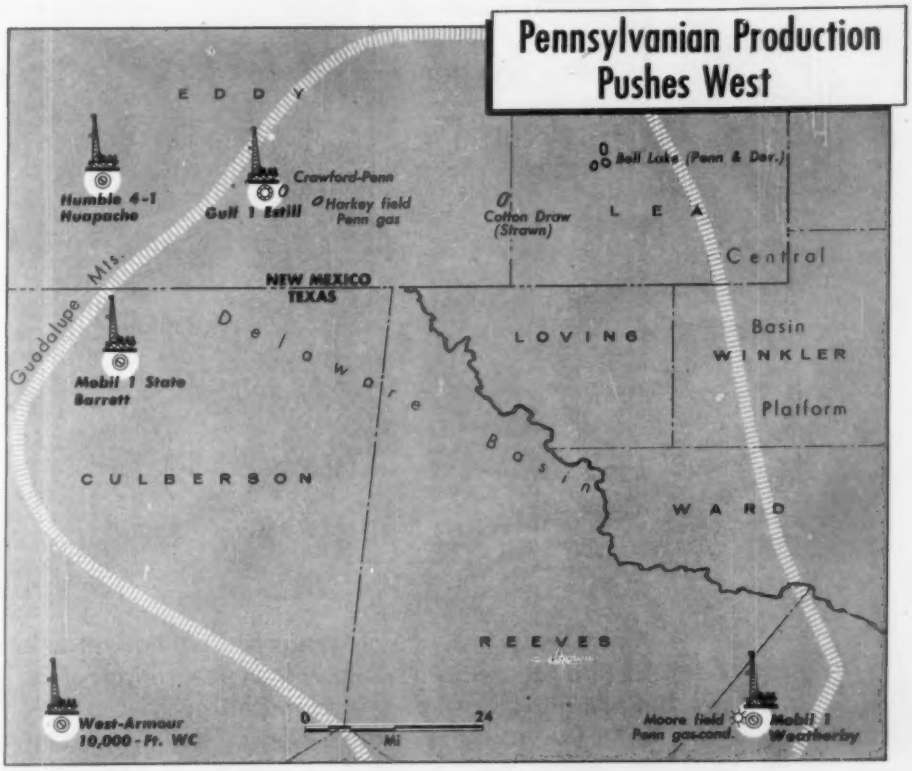
59-19

Pennsylvanian Production Pushes West

BY PETER B. BIKE



ENCOURAGING gas strikes have been made in the Pennsylvanian of the Guadalupe Mountains - Delaware basin region. In addition to the tests now drilling, there are three more of note—Gulf 1 N. Cavern Unit, northwest of the Estill in Eddy County, and two Campbell efforts off the map to the west in Otero County, New Mexico.

Guadalupe Mountains loom as new gas province

WHAT IS BEHIND the big push for exploratory drilling in the wilds of West Texas and Southeast New Mexico? One thing is certain—you can't argue with success. The wildcats have enjoyed that—new successes in the Pennsylvanian section.

Take the Mobil Oil Co. 1 Moore in Pecos County, Texas, for example. This recently completed gasser became the first Pennsylvanian producer in the Texas portion of the Delaware basin. Granted, there were at that time four fields in New Mexico's part of the basin—Cotton Draw (Strawn), Harkey (Penn.), Bell Lake (Strawn), and Crawford (Penn.) producing from this section, but the nearest field is 80 miles away. The 1 Moore had the double distinction of being a new-zone opener for the area and simultaneously the deepest producer in West Texas to date. However, the Atlantic Oil & Refining Co. 1 Kelly is testing above TD at 19,696 ft. and is threatening the Moore's record. Lying 23 miles from nearest production at Fort Stockton to the southeast, the Moore flowed 102,000 M.c.f. of gas and 1,500 bbl. of condensate daily at 15,147 ft.—probably the most important Delaware basin hit in years. An east offset to the Moore, Mobil 1 Weatherby in Section 20, Block 48, T-8 T&P Survey, is drilling below 10,964 ft.

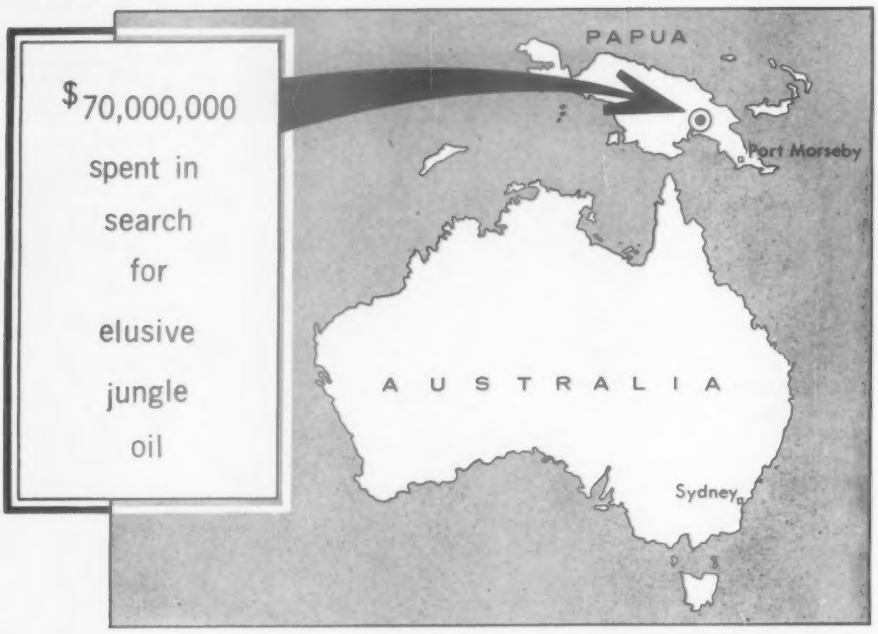
Swinging northwestward to Culberson County there are two remote ventures working. On the northwest extremity of the Delaware basin the Mobil 1 State-Barrett is an indicated strike from the Permo-Pennsylvanian, having tested 2,500 M.c.f. of gas on open flow daily at an interval of 5,838-5,933 ft. Plans call for a 10,000-ft. test for this well which is 40 miles west of nearest production. This location, 12 miles east of Pine Springs, would be the westernmost well in Texas if completed successfully. Hole is below 7,365 ft.

To the south in the same county, Wesley West and Lacy Armour of Houston will deepen an abandoned effort from 6,560 ft. to 10,000 ft. The site is 26 miles northeast of Van Horn on a 16,000-acre block. No production occurs in this immediate area. The initial hole was completed dry in 1959.

New Mexico humming too. In Eddy County, Gulf Oil Corp., 1-AD Estill is considered an important Pennsylvanian discovery. On a recent potential test it made nearly 47,000 M.c.f.d. on open flow with 4.2 bbl. of 58.4°-gravity condensate per M.M.c.f. gas from Atoka at 9,806-16 ft. after acid treatment. Location is NE NE 29-24s-26e, 16 miles south of Carlsbad. The well was plugged back from a total depth of 12,212 ft.

Jumping 22 miles west of the Gulf venture, Humble Oil & Refining Co. 4-1 Huapache in SW SW 14-24s-22e, in Eddy County 33 miles southwest of Carlsbad, tested 80 M.c.f. gas daily from the Pennsylvanian at 5,412-38 ft. This potential discovery is working below 6,796 ft. It could open westernmost production in entire Permian basin region.

All this activity simply means that success is warming up the area. As we said, there is nothing more encouraging for any locale than a few good strikes. Look for more completions here in the land where Lady Luck is smiling on Pennsylvanian gas seekers.



Australia is an oil-hungry nation. Oil has yet to be discovered in commercial quantities. All the oil in Australian refineries is imported from the middle East and Indonesia. Because of this, the Australian government subsidizes companies in the exploration for oil, not only in Australia itself, but in its mandated territory of Papua on the island of New Guinea.

Dry holes fail to dent Papua hopes

BY BEN MULLER, Baroid News Bulletin, Houston

AN S-58 helicopter comes in for a landing carrying supplies to the Papua helirig, Bwata 1.

MORE THAN $100,000,000 has already been spent in the search for oil in Australia and Papua without any commercial success. Despite failure exploratory efforts continue steadily.

In Papua four wildcats were completed in 1958—all dry holes. Hopes for a major oil discovery in Papua, where more than $70,000,000 has been spent since 1939 with little more than minor shows, were dashed in November 1958 when the Australasian Petroleum Co.'s 10,000-ft. Puri 1 turned to salt water shortly after producing 3,500 bbl. of crude at the daily rate of 1,700 bbl.

Long search. Australasian Petroleum Co. has been engaged in the search for oil in Papua for the past

solved by MAE*
the case of the masked reflection

"Singing" marine seismic records, on which valid subsurface reflections are masked, were once an unsolved case in offshore exploration.

Today "singing," or water reverberations can be eliminated by data processing through MAE, GSI's Multiple Analyzer Eliminator. MAE processed records provide information which was impossible to obtain in the past.

GSI can process your records through MAE in several locations. If you are planning a marine seismic program in an area where water reverberations are a problem . . . or if you have a backlog of magnetically-recorded data which is masked by the singing effect, you will want to meet MAE.

**MAE is a GSI trademark*

For a descriptive article on how MAE solved the case of the masked reflection, write GSI.

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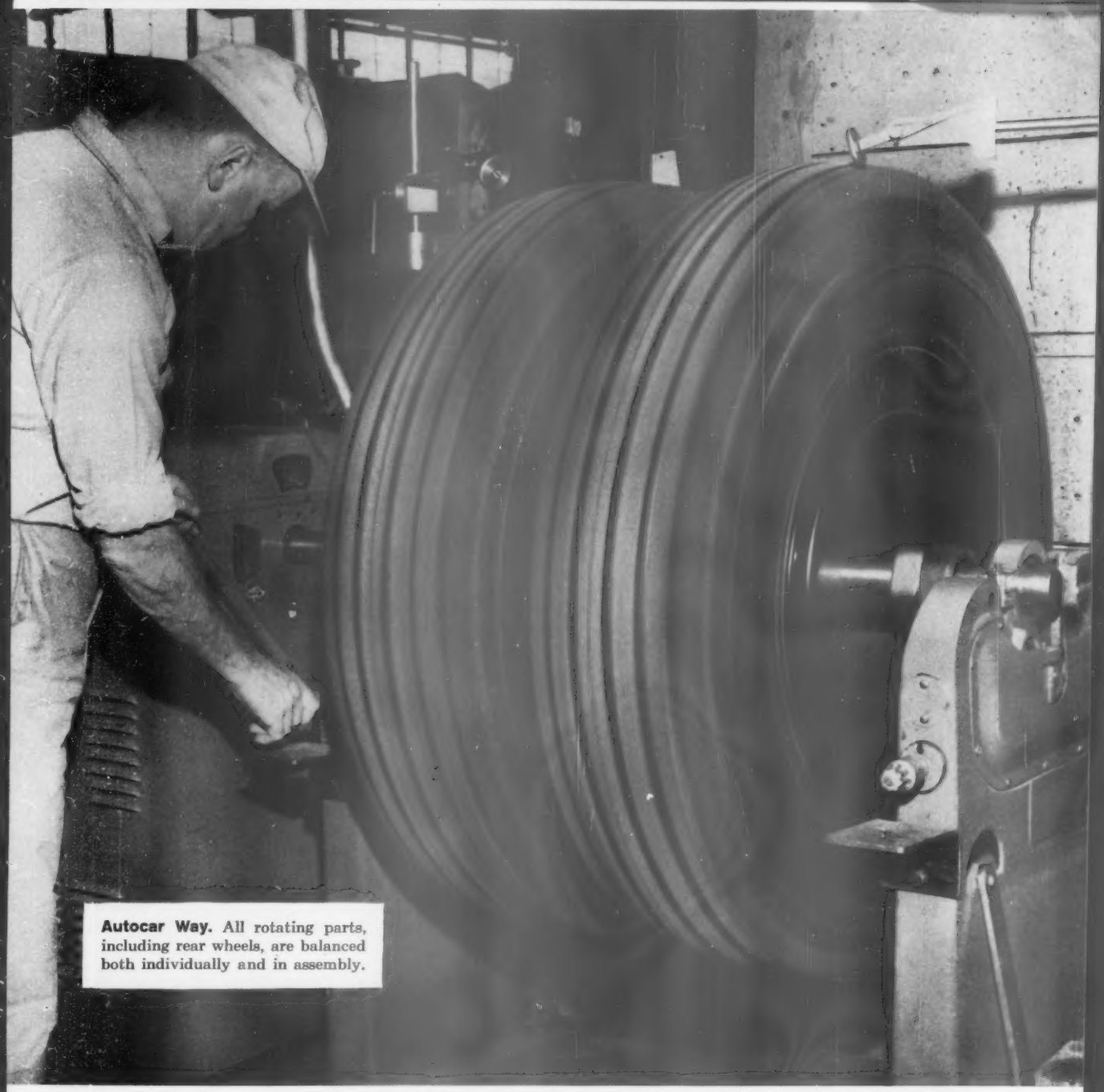


Autocar Way. All rotating parts, including rear wheels, are balanced both individually and in assembly.

Better Balance...as you find it in the "World's Finest"

Better balance means improved performance. Means less maintenance. Means more driver comfort.

Better balance is an exclusive Autocar quality. Every rotating component in an Autocar is balanced with meticulous care. Hubs and drums, wheels, front and rear tires, for example, are balanced both individually and in assembly. Drive shafts are balanced at speeds up to 3,000 rpm to within *one ounce inch.*

That's balance. That's quality. That's how Autocar provides the greatest performance. Why take less than the "World's Finest"?

Autocar
"World's Finest"

Division of
The White Motor Company, Exton, Pa.

THE SEARCH FOR OIL in Papua brings men from all over the world. This shack provided temporary quarters for transient personnel visiting camp at Bwata—men from Australia, New Zealand, the British Isles, Scandanavia, eastern and western Europe, and North America.

SUPPLYING HELIRIG is a day-long project in Papua. Here native workers unload palatized Q-Broxin at the Era base camp. This load will in turn be flown by helicopter to rig location deep in the jungle.

21 years. During this time the company put down 18 wildcats. These wells were drilled in the delta area of the Gulf of Papua, near the banks of navigable rivers or a few miles from river landings through the busy by road. These roads are usually built through very dense jungle and at times very rugged pinnacle limestone country, with costs running as much as $50,000 per mile. One location road took 17 months to build.

Field parties. Preliminary geological and geophysical exploration is done by field parties with portable equipment carried by native bearers. The geological party maps outcrops, dips and strikes as they are observed along the banks of rivers. The jungle mass prevents normal surface mapping. The geophysical crews drill and shoot their holes along "dahlas" (tracks) cut straight through the brush. Their small shot-hole rigs are portable, and drilling water is supplied from rivers and creeks nearby.

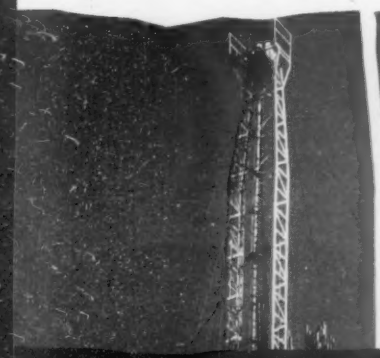
Helicopter clearings are spaced every 5,000 ft. along the dahlas in the flat country, and every 2,500 ft. in the rougher hill country. Small Bell helicopters are used to supply the parties and transport them along the seismic line. Before helicopters were put into service, the parties were supplied by parachute drops from a Catalina flying boat.

In 1957 three Sikorsky S-58 heli-

MANY FLIGHTS PER day are necessary to keep the rig and other location installations supplied with diesel fuel. This fuel run is one of many jobs taken in stride by the versatile helicopter.

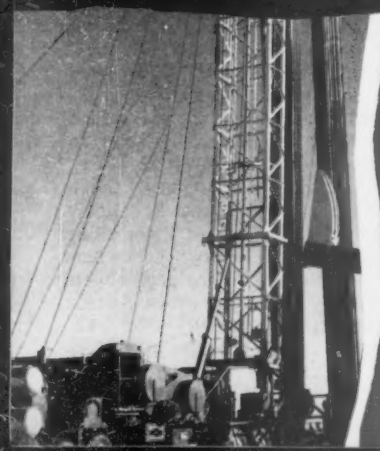
copters operated by World Wide Air Services were introduced to help speed up drilling and to reduce road-building costs. Australasian Petroleum also developed the "helirig," a specially designed rig that can be transported by helicopter.

Helirig site. To make a helirig site, a clearing party cuts a dahla into the location from the base camp or nearest river and clears an area large enough for a helicopter. A D7 caterpillar is disassembled, flown in and reassembled to clear an area of about



Wilson

When more horsepower is needed . . . . . .



Easy enough, you say, on most rigs. But how about a self propelled rig? The *Wilson Winchmobile*, with cross-mounted engine, or engines, is the answer. Compounded, the engines both drive the winch drums and the rear axles. For really deep wells, this is the answer.

30 acres. Power saws are also used to fell trees that reach heights of 150 ft. Quarters and facilities are flown in and constructed for the 14 white men and 80 natives needed to drill the well.

The S-58's can carry a maximum load of 4,000 lb., and the helirigs had to be specially cut down. National 50 draw works are cut in half and dismantled. National C-150 mud pumps are broken down, the heaviest piece—the fluid end—weighing 3,970 lb. The rig and accessory equipment such as the cementing unit, the Schlumberger electrical logging unit, water pumps, tanks, and electric power plants, are all flown in following a set sequence so that they may be assembled properly with the least need of movement. The helicopters are actually used as a gin pole in rigging up.

By the time the rig is ready to spud in, over 400 flights have been made in less than a month's time, weather permitting, and about 800 tons of equipment moved.

ERA, PAPUA, base camp for Bwata and Puri sites. It is from base camps such as this that helirig locations are supplied and manned. From here clearing parties cut dahlas into the location area.

International effort. World Wide Air Service of Paris has pilots from many countries. Indeed the personnel of Australasian and WWAS and other ancillary contracting companies associated with oil exploration in Papua represent many nationalities. Men from all parts of Europe, Asia, North America, and Africa pass through these bush camps. When oil is finally found in Australia and Papua it will be the result of an international effort.

Drilling. Drilling in Papua is similar to that of the Texas Gulf Coast

How Leading

Drilling Contractors Cut Costs

Competition in the contract drilling industry was never keener. Drilling contractors must find new ways to lower their operating costs if they are to show a profit.

It is significant that many of the leading drilling contractors depend on equipment sold and serviced by Jones & Laughlin Supply Division. These leaders discovered long ago that lower first cost did not always mean lower final cost. They know they must use equipment that will give them more performance hours per dollar invested. This is why you'll find quality drilling equipment sold by Jones & Laughlin on the job for these industry leaders.

Backed by J&L service with field stocks of expendable supplies and replacement parts, these drilling contractors have cut their costs consistently.

Quality equipment and dependable service can lower *your* operating costs, give you the edge on competition. See your local J&L man today.

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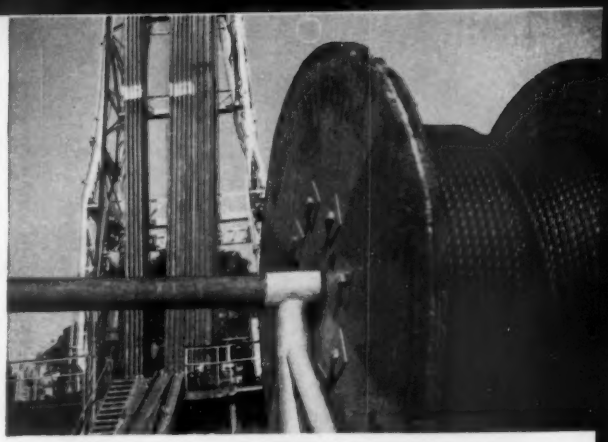
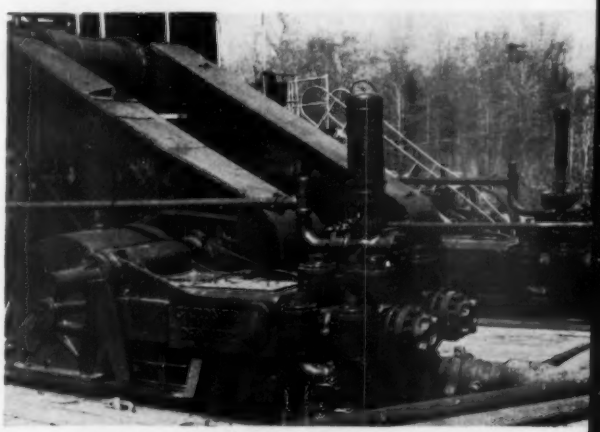
If it's sold by J&L....
It's the best available 101

J&L's quality Blue Ribbon Drill Pipe is preferred by the drillers of the world's deepest wells. The J&L quality control program is the most exacting known. Ask your J&L Supply man for a beautifully illustrated 24-page booklet on oil country tubular goods.



Because of unusual quality in materials and construction, J&L Wire Rope gives more ton miles. Result: Lower operating costs per foot of hole.



Three Gardner-Denver Mud Pumps on a well in Mississippi. Replacement of all Gardner-Denver parts can be made in the field, and these parts are as near as your J&L Supply store.

No tools needed to lay your temporary galvanized steel lines with McDowell "Fast-Line" Couplings. You save up to 80% installation time. Ask for illustrated booklet.

AERIAL VIEW of Era base camp. European quarters are in the rear, stores and offices, dock, and heliport are visible. This is home to the 14 white men and 80 natives needed to drill a well.

DRILLING CREWS could actually cook eggs with the heat of the drilling mud at Innamincka 1, located deep in the geographical center of the Land Down Under.

and comparable hazards are encountered—lost circulation, high-pressure gas, and salt-water flows, crooked hole, and heaving shales. Mud weights of over 19 lb. per gallon have been used to control high pressures at a depth of 6,000 ft. Lime muds and saturated salt water emulsion muds have been used with success.

Formations penetrated are mostly Cretaceous and Tertiary. Basement was reached at one well at 1,800 ft., and another at over 13,000 ft. This gives an idea of the diastrophism that has occurred in this area. Formations penetrated often exhibit an angle of repose of 65°-70°. Slickensiding is shown in some mudstone cores. Weather is one of the big troubles. If rivers are low, barges can't deliver mud materials to the base camp. Bad weather also disrupts the helicopter schedules.

Regional picture. Papua is located on the eastern side of the island of New Guinea. It is an Australian mandate. New Guinea is part of the vast Southeast Asian island kingdom of Oceania. Oil is found on the Oceania islands from Sumatra on the west to the western tip of New Guinea on the east.

Except for the mountain core, New Guinea is covered with a thick veneer of sediments. Most of Papua is covered with basin deposits and promising areas for petroleum.

NEW PLASTIC-COATED

EDWARD VALVES GIVE LONGER WATERFLOOD SERVICE LIFE

Now you can get economy-priced forged steel valves and strainers with a tough plastic coating baked on the inside. EValcoat*, an exclusive Edward plastic coating, assures greater protection from the corrosive and erosive effects of salts and sulphides in waterflooding service, as proved by actual field testing. These new Rockwell-built Edward valves work equally well in other secondary recovery and pressure-maintenance systems.

To assure superior throttling control—especially important when balancing a flood system—the new Edward Figure 2498 plastic-coated globe valve features a specially sized and shaped stainless steel seat and disk.

*T.M.

Figure 2498
2000 lb. WOG
1" Size, Inside Screw,
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Exclusive Advantages of EValcoat Plastic Coating

- **Hardness coupled with elasticity. No need to "baby" the valve during installation**
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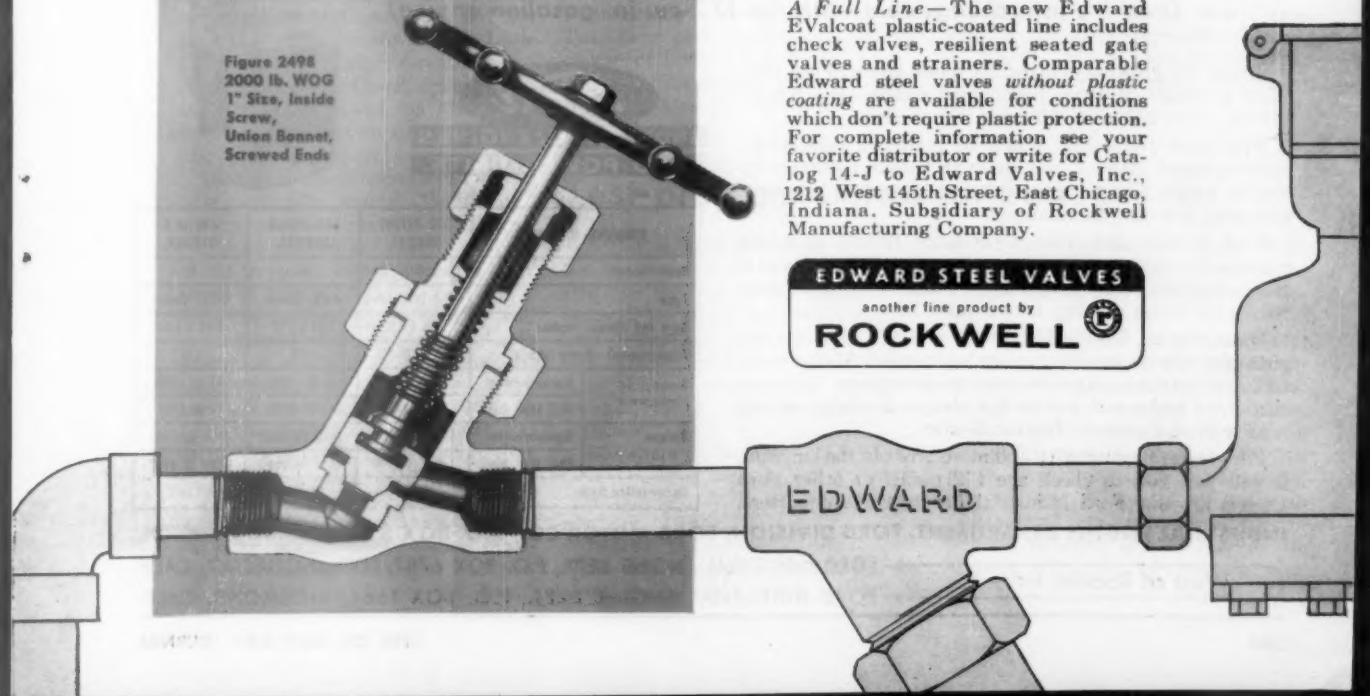

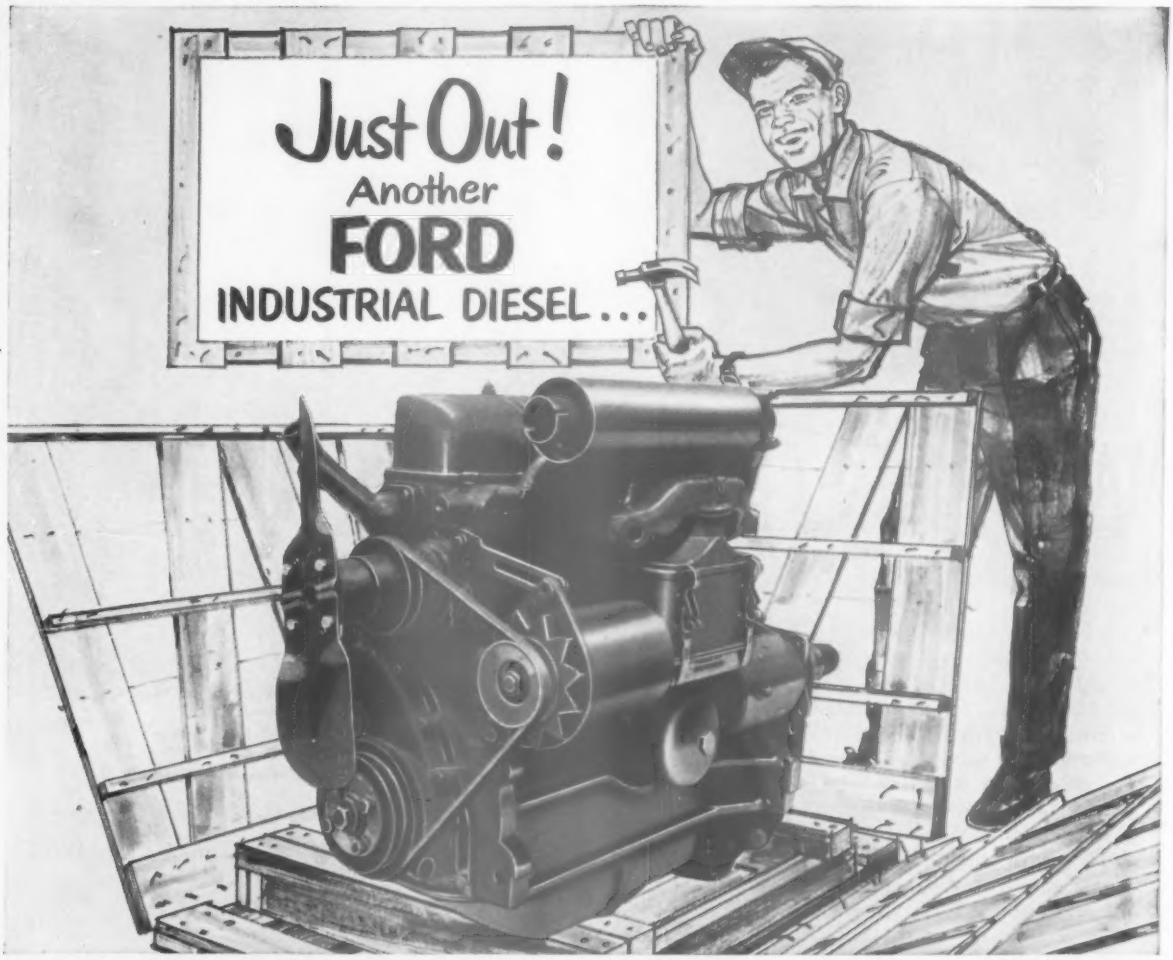

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Displacement—Cubic Inches		172	220	330
Brake Horsepower	Dynamometer	59 @ 2400	60 @ 2250	96 @ 2250
	80% Dyn. BHP	47 @ 2400	48 @ 2250	77 @ 2250
Torque	Dynamometer	140# @ 1200	151# @ 1600	236# @ 1600
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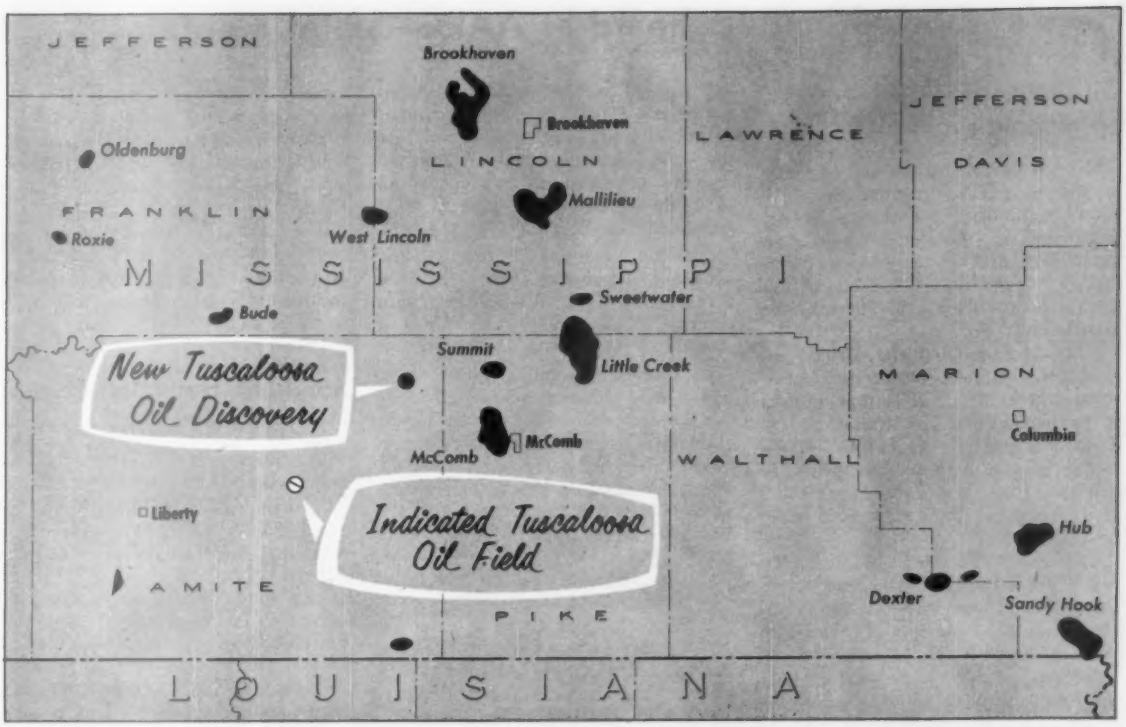


SMITHDALE is Mississippi's newest lower Tuscaloosa oil newsmaker, discovered by Larco Drilling Co.—Sun Oil Co.

Mississippi strikes stretch Lower Tuscaloosa

ANOTHER Little Creek or McComb field may be in the making in a new Lower Tuscaloosa oil discovery by Larco Drilling Co. and Sun Oil Co. in northeastern Amite County, southwestern Mississippi.

The discovery well is only 6 miles northwest of McComb field and less than 15 miles southwest of Little Creek. Both McComb, discovered last August, and Little Creek, opened early in 1958, have proved top Mississippi Tuscaloosa fields with sizable and prolific producing areas.

Discovery characteristics of the new field, officially named "Smithdale," are comparable generally to those of McComb and Little Creek. Pay zones of the three are within a relative close range of depths.

Pay of the Larco-Sun discovery well is perforated at 11,062-68 ft. in hole drilled at 11,319 ft. From derrick-floor elevation of 437 ft., top of the Lower Tuscaloosa is at 10,970 ft. At Little Creek, the tops are in the 10,200 to 10,300-ft. range. At McComb, they range from 10,400 to 10,450 ft.

On potential test the new well flowed at the rate of 336 ffl. of oil daily through 10/64-in. choke. Flowing pressure was 2,100 psi. and gas-oil ratio 1 M. cu. ft. per bbl. Later, on 7/64-in. choke, the well flowed 157 bbl. daily with pressure of 2,080 psi. Gravity of the oil is 42.2°.

Except for the one-well Gillsburg field, more than 20 miles south of the Louisiana border, this is the only production in Amite County. It marks a southwesterly extension of the new Tuscaloosa play, revived with the discovery of Little Creek field.

In the meantime, another Amite County wildcat 9 miles farther southwest has given indications of commercial production from Lower Tuscaloosa sand. It is C. F. & H. Oil Co.'s 1 Crosby, in 29-3n-5e. Testing a stringer sand just below the top of the Lower Tuscaloosa with perforations at 11,285-95 ft., it flowed by heads at the rate of 4 to 5 bbl. per hour. Since then it has been reperforated from 11,284 ft., and is expected to make a pumping well. Pumping equipment now is being set up.

Test program slated for Senegal

A NEW stratigraphical test well has been started in Senegal, West Africa, for the Societe des Petroles du Senegal, in which the British Petroleum group has a 50% interest. This well, known as 1 Nord Casamance, is in Senegal south of the Gambian frontier, about 40 miles from Zinguinchor.

Elsewhere in Senegal, a BP exploratory party is carrying out a seismic reflection survey in an area to the north of Medina.

Nearby, in Gambia, a contract party is carrying out a seismic survey along the Gambia River, on behalf of BP and the French group BRP, who have each a 50% interest in an exploration license covering the territory.

BP is associated in plans to drill a further series of stratigraphical test wells in Senegal and Gambia. These will include a number of shallow holes in the Societe des Petroles du Senegal's new concession in the area to the east and south of Linguere, one on the Bathurst peninsula in Gambia and one to the north of Bathurst (in Senegal) and another in the extreme northwest of Senegal, near Louga.

Here's what oil hunters heard at AAPG–SEPM meeting

Oil finders briefed on Mohole project

Oil finders at the annual meeting of the AAPG in Atlantic City recently were briefed on the scientific objectives of "Project Mohole," an attempt to drill a hole thousands of feet below the ocean floor to obtain a sample of the rock beneath the earth's crust.

The Mohole will be drilled in either the Atlantic or Pacific Ocean basin where the crust is thin enough to be penetrated. The operation will be conducted by the AMSOC Committee of the National Academy of Sciences from a drilling barge especially modified for very deep-water operation.

Dr. Harry H. Hess of Princeton made predictions of what the scientists will find when they examine samples from various levels above and below the crust. Henri-Georges Doll, Schlumberger Well Surveying Co., discussed the possibilities of obtaining other data from the Mohole, such as the amount of natural radioactivity, density, porosity, and sonic velocity, by means of electrical equipment now commonly used to record data in oil wells.

East Coast ocean troughs may yield oil

Although more than 200 test wells have been drilled without producing any sign of oil on the coastal plain north of Florida, scientists James Trumbull and John E. Johnston of the U. S. Geological Survey reported recently that there may be plenty of oil along the 1,100-mile continental shelf on the east coast of the United States.

The oil potential of the Atlantic coastal plain and shelf was the subject of today's session of the joint meeting of the AAPG and SEPM at Atlantic City.

Near-shore marine sediments and continental sediments deposited along the "basement" rock of the ocean floor seemingly constitute a setting favorable for the accumulation of oil. The continental slope from Newfoundland to Puerto Rico, according to Dr. Bruce C. Heezen of the Lamont Geological Observatory, Palisades, N. Y., forms a continuous outcrop of potential oil-producing rock.

During the past 20 years extensive geophysical investigations have been carried out along the Atlantic coastal plain of the United States which have helped to determine the geological structure of the offshore area between Newfoundland and Cape Hatteras in some detail. The predominant features are two long troughs paralleling the edge of the continental shelf. The inner trough contains up to 18,000 ft. of potential oil-producing sedimentary rocks, while the outer one contains more than 25,000 ft. of sedimentary rocks in some places.

Geologists Charles L. Drake and Maurice Ewing of the Lamont Geological Observatory report that the picture south of Cape Hatteras is not as clear, but most researchers seem to believe that the potential oil field extends southward along the Florida coast.

The consensus among the oil men meeting at Atlantic City is that the greatest oil potential lies along the continental slope between New Jersey and Florida.

Sand-bar formation holds clues to new oil

Where do sand bars and beaches come from? How do they get started? Edwin D. McKee, USGS, gave an answer recently to 2,500 oil finders at a meeting of the AAPG in Atlantic City.

The shape, size and orientation of sandstone bodies are being studied by petroleum geologists in their continuing search for new ways to locate potential oil fields. Geologist McKee reported on experiments conducted in a 45-ft. wave tank at the Sedimentation Laboratory of USGS in Denver.

Offshore sandbars develop at the point of wave break. In very shallow water an emergent bar commonly forms; in deeper water a submarine bar is built; in still deeper water no bar develops.

Strong waves build a bar toward and even onto the beach. Weak waves build upward to form barriers with lagoons toward the shore.

Third major enters gas hunt in Canadian Rockies

THE Rocky Mountain front gas play area of southwestern Alberta added another member. Pan American Petroleum Corp. acquired its first acreage in the Coleman-Carbondale region. The deal was consummated with one of the largest coal companies in western Canada, Canadian Colleries, Ltd. This coal firm has held petroleum and natural-gas rights to Federal Government grant lands since before the turn of the century, and recently posted them for public tender.

Play should grow. With Pan American in the play, things could become very interesting in the general mountain front area since Shell Oil Co. of Canada, Ltd., and Texaco Exploration Co. were the only other majors previously busy there. Those two companies have already been paid rich rewards for their work uncovering such fields as Waterton Park, Castle River, and Carbondale.

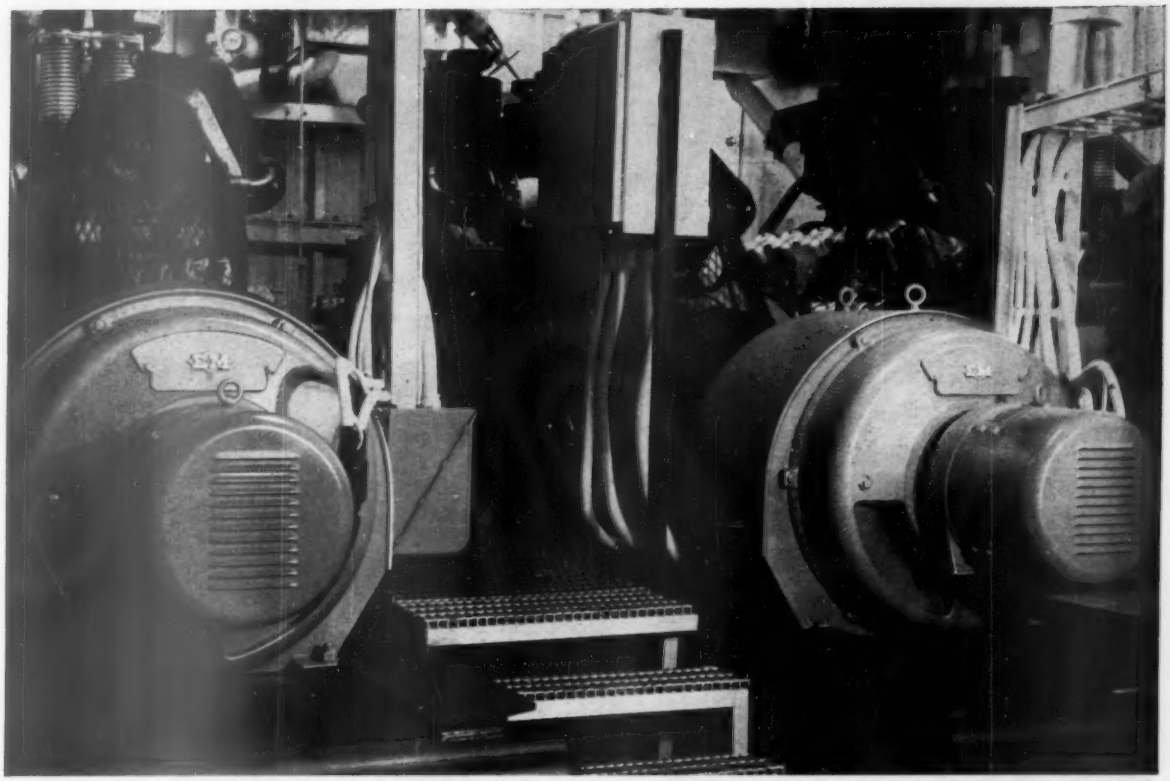
Pan American's new acreage bit falls immediately between the Carbondale discovery well and a wildcat that Shell is drilling in the Coleman district, some 20 miles northwest. The Carbondale wildcat found gas in the Wabamun Devonian, and extending the limits of the Mississippian pay as well.

Included in the agreement was a total of 18,960 acres of petroleum and natural-gas leases falling in Townships 6 and 7, Range 3 West of the Fifth Meridian; and in Townships 7 and 8, Range 4 West of the Fifth Meridian. The leases run for 10 years.

Pan American paid a cash bonus of $450,000 for the leases. Canadian Colleries and affiliates, Hillcrest Colleries, Ltd., and Byron Creek Colleries retained the normal 12½ % gross override on production, and also a 37½ % working-carried interest.

Deep test. For the drilling of one 12,500-ft. Wabamun wildcat within 75 days of agreement, Pan American will validate the contract. If that well is dry, it will have earned interest in four sections, but has the option to drill a further test to earn an interest in the rest of the acreage. If it produces, a continuous drilling program, depending on market conditions, has to be undertaken.

Those market conditions should not be long in coming as the acreage falls within the scope of the proposed Foothills Division of the Alberta Gas Trunk Line which will be the feed



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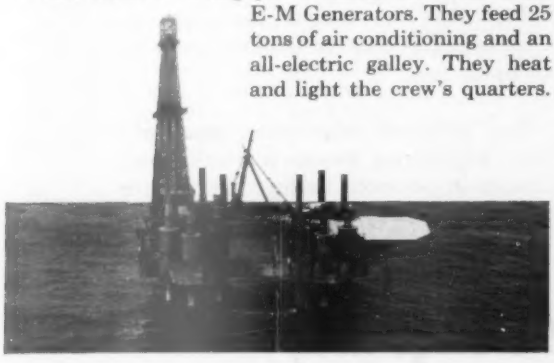

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line for the Alberta-to-California pipeline recently approved by both the National Energy Board and the Federal Power Commission's Examiner.

Early start. A quick start is anticipated on the first hole in this project which will follow a limited seismic evaluation of the properties. While this is the first Pan Am-held acreage in southwestern Alberta, the firm does have an option on a further 17,000 net acres in the Savanna Creek area, about 25 miles north of the new leases.

Canadian Colleries is a firm not unknown to the oil industry. Because of declining coal sales, the company diversified its activities. A subsidiary, Cancoll Oil & Gas, which had extensive oil holdings at Pembina, was sold in 1955 to Merrill Petroleums, Ltd., for $18,000,000. From those proceeds, the company purchased timber interests. As well as those, the company also has holdings in iron ore, real estate, and other oil and gas properties. Byron Creek Collieries is a subsidiary of Hillcrest Collieries, who in turn, is associated with Canadian Colleries.

Castiac Junction extended in California

Los Angeles County's deep Castiac Junction field was given its most northerly producer to date by Humble Oil & Refining Co. with a well in NW SW 18-4n-16w.

The Humble well, 66 N.L.&F., was completed in intervals at 13,100-13,-230 ft. and 13,260-80 ft. flowing 474 bbl. daily of 32.2°-gravity crude through a ⅝-in. choke.

River Island active in California

Drilling activity in the bustling River Island gas-field area of San Joaquin County was highlighted by a major extension completed by Brazos Oil & Gas Co. on the east edge of the field. The Brazos well, 3 Brazos-Sunray, was completed making 1,750 M.c.f.d. through a 14/64-in. choke. The perforated interval in the 5,792-ft. well was 4,105-14 ft.

Big gasser for California's Buckeye

Western Gulf Oil Co. was completing a big gas well about ¾ mile southeast of its Buckeye gas field discovery in Colusa County. The new well, 1 Wilkins Unit B, flowed at a rate of 8,449 M.c.f.d. through a ½-in. surface choke from an interval at 8,141-56 ft.

New gas field for California's San Joaquin

Great Basins Petroleum Co. continued its aggressive gas-exploration program in Central California with a new field discovery in San Joaquin County about 5 miles north of the Vernalis field. The discovery, 66-23 Signet-Whiting, tested at a rate of 2,500 M.c.f.d. on a drill-stem test of an Upper Tracy sand interval at 5,941-48 ft. The operator plans to continue drilling to determine the sand thickness and the number of zones in this multizone area. The well is on an 800-acre farmout Great Basins has from Signet Oil & Gas Co. In addition to this farmout acreage, Great Basins' holdings include some 25,000 acres on the northwest-southeast trend.

Slave Point gas strike reported in British Columbia

The Cam Lake wildcat drilled by Pan American Petroleum Corp. found gas in the Slave Point Middle Devonian 85 miles north of Fort Nelson in northeastern British Columbia.

Pan Am's well, located midway between Petitot River and Celebita Lake fields flowed 6 M.M.c.f.d. from perforations between 6,756-95 ft. The A1 Cam Lake well is location of Quarter-Unit c, Unit 31, Block I NTSI Map 94-0-16. It lies 11½ miles northwest of Petitot River field and 15 miles southeast of Home Oil Co.'s recent Celebita Lake discovery in the Northwest Territories.

Shell has success at Canadian gas well

IN ALBERTA Shell Oil Co. of Canada, Ltd., has indicated natural-gas success at another well in the general Worsley district, 70 miles northwest of Peace River and 75 miles northeast of Fort St. John. The new indicated success is the second followup attempt to the firm's discovery well drilled during 1959 and the first to extend the productive reef. It is estimated that a 90-ft. pay sector is present in the recently drilled well and during initial test in the reef flow rate was measured at 4 M.M.c.f.d. During the evaluation, condensate sprayed to surface and 120 ft. of condensate was recovered from the drill-stem.

Cardium oil found at Crossfield Trend well

Light-gravity crude oil was found in the Cardium Cretaceous at Bailey Selburn Oil & Gas Co., Ltd., wildcat in the Crossfield-Carstairs trend area of southwestern Alberta.

The 16-31 Crossfield well, LSD 16, 31-28-2w5, northwest of Calgary on the 35-mile long trend that stretches from Beddington to Crossfield, recovered 550 ft. of clean oil and 410 ft. of oil and gas-cut mud on drill-stem tests. The test was at 6,708-6,805 ft. The new well lies between the 11-mile stretch that separates the most southerly producer in Carstairs Cardium pool and Shell Oil Co. of Canada's Crossfield A13-2 Cardium sand oil well.

Eastern Canadian spring drilling begins

Spring drilling is under way in southwestern Ontario's South Colchester area, one of the major oil fields in eastern Canada.

Imperial Oil, Ltd., has a six-well program going with Colchester and Moore Townships dividing the activity. The Acme-Putnam well is a producer. No figures are in yet, but it is expected to make over 100 bbl. daily from Trenton Ordovician. The Imperial 11 well flowed 240 bbl. per day from Trenton.

The field has several wells onshore and one producing offshore in Lake Erie. Place Oil & Gas Co. will complete some wells in lake waters this season, further delineating this major oil-discovery area.

Indiana sprouts important new field

A SPENCER COUNTY area in southwestern Indiana has grown into an impressive new oil field. Union Chapel field, opened 6 months ago at A. B. Doty-Otis Greer 1 Curtis Mills in NE SE NW 6-6s-4w, was completed in November 1959 for 118 bbl. daily, pumping and flowing natural from Jackson Mississippian sand at 677-700 ft. There are now 19 wells in Section 6, of which 7 made 200 bbl. daily.

Charles J. Schroll has three producers on the George Foertsch lease in Sections 30 and 31-5s-4w. Each of these made 30 bbl. per day from the Jackson pay. The 4 Foertsch in NW NE NE 31-5s-4w, is spudding in. Other operators in the area are Calstar Petroleum Co., Cox Drilling Co., W. W. Damron, A. B. Doty, Otis Greer, Stanley Lambert, J. C. Miller, Mount Carmel Drilling Co., and James Greer.

Other basin news. In Gibson County, Indiana, I. F. McCandlish swabbed 5 bbl. of oil and 1 bbl. water per hour from McClosky lime at 2,020-28

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ft. at the 1 Robert and Oscar Lanphar Unit in SW SE SE 13-1s-11w, north of Patoka. This well is 1½ miles from similar production.

In Scott County, Illinois, 1½ miles southeast of Winchester and 40 miles southeast of the shallow Brown County play on the northwest side of Illinois basin, Wildcat Oil & Gas Co. set casing for Devonian lime tests at 521-28 at a remote wildcat. The 1 O'Donnell is the first well in the county. It lies in SEc NE NE SE 4-13n-12w.

Southwest Kansas opens Mississippian field

Mississippian production is reported at a wildcat in Seward County, Southwest Kansas. The discovery well is Falcon-Seaboard Drilling Co. 1 Salley in C NW 33-33s-33w, 6 miles northwest of Hayne and 9 miles east of Shuck field.

The well flowed 258 bbl. of 40.3°-gravity oil daily on ¼-in. choke from Chester perforations at 6,194-6,207 ft.

New gas field opens in St. Landry Parish

South Louisiana's St. Landry Parish gained a new gas producer at Forest Oil Corp. 1 Ned A. Pellerin in 59-7s-3e. The well flowed 2 M.M.c.f.d. from a 20-ft. pay zone, topped at 11,260 ft. Gas was gaged on a 1½-hour test through ⅛-in. choke. Location is 2½ miles southeast of Lawtell field.

Lake Boeuf. Jay Simmons reports a gas-condensate flow at 1 Ayo, a south extension try to Lake Boeuf field in Lafourche Parish.

The well tested 1,200 M.c.f.d. with 30 bbl. condensate per million from perforations at 10,564-74 ft. Gage was on ⅛-in. choke. Location is in 33-15s-18e, 1¼ miles from production.

Map available on South Louisiana

A large-scale map showing the locatiions and outlines of producing limits of all oil and gas fields of South Louisiana and its offshore areas has just been completed by Drafting Services Co., Lafayette.

Offshore areas, including their new extensions, are subdivided into their respective blocks, and approximate water depths and lines of the several zones are indicated. Scale of the map is 1 in. to 5 miles. Drafting Services Co. has its offices in the new Oil Center in Lafayette.

Scipio semiwildcat drills loss zone

A SEMIWILDCAT 3 miles southeast of the farthest-south end of Scipio field, Hillsdale County, drilled loss zone in the Trenton-Black River at 4,099 ft. Test is being developed by C. J. Simpson of Dallas at 1 Sponseller, NW NW NW 4-6s-2w, Adams Township.

Trenton logged at 3,555 ft. and drill-stem at 3,760-3,951 ft. was near negative with 150 ft. gas and 45 ft. mud. Loss zone took 6 bbl. of water per minute. Unable to regain circulation, the test was cased and cemented.

Loss zones, common to the Trenton in southern Michigan and frequent starters of costly blowouts, without exception through the play have been forerunners of commercial gas or oil.

Simpson's wildcat, his first in Michigan, is less than 2 miles north of a "freak" play that saw two commercial wells drilled last fall, followed by 13 dry holes, including two 20-acre offsets.

Most Southern Michigan counties were lifting load limit restrictions this week, which is expected to start a general upswing in drilling.

Michigan prospects grow brighter

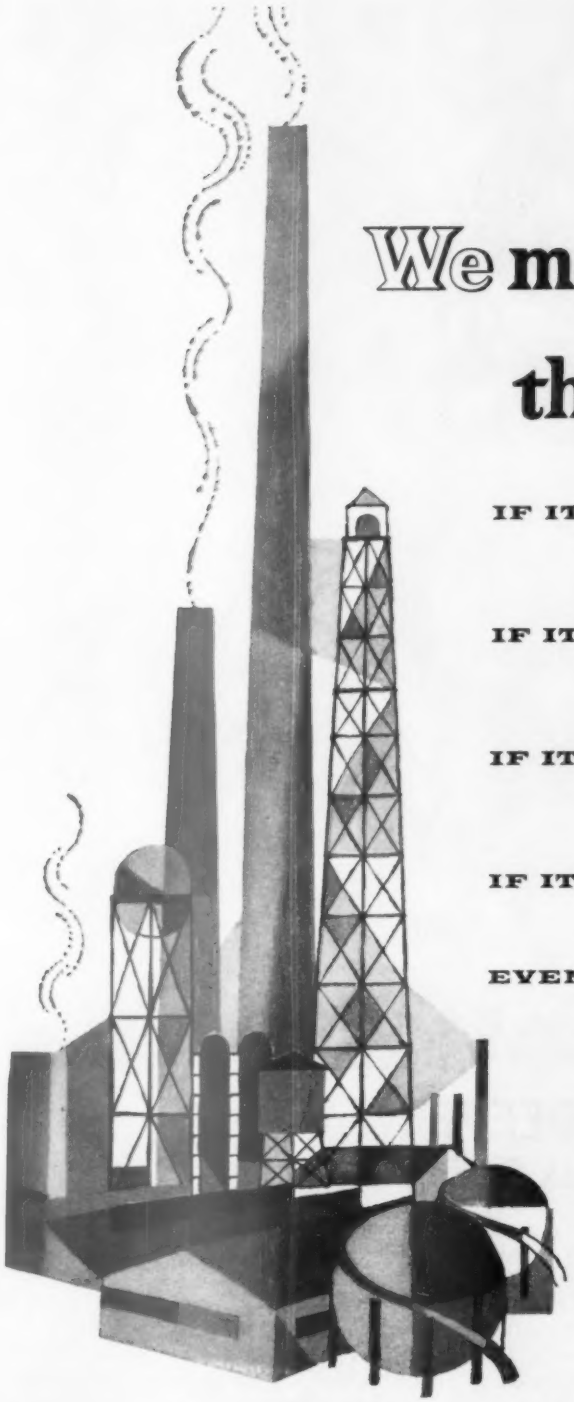
PROSPECTS in southern Michigan continue to brighten with no end in sight yet for the Scipio Trenton-Black River production trend.

Newest sensation in the play is Perry Fulk 1 Ripley, NW SE NW 26-1s-5w, 9 miles northwest of Albion, which tested gas and oil on drill-stem at 4,596 to 4,806 ft. Test showed gas in 15 minutes and 2,500 ft. oil in 1½ hours, with 1,906 psi. closed in pressure. Trenton logged at 4,233 ft. and Black River shale at 4,584 ft.

● Sun Oil Co., Ohio Oil Co. and Murphy Oil Co. are strong in the expected action on the basis of lease holdings.

Fulk-Ripley 1 is 5 miles northwest of Fulk & McClure 1 Winter, NW NE NE 19-2s-4w, waiting on completion but tested on drill-stem for flowing oil at 4,158 to 4,236 ft. Winter is over 3 miles northwest of the present development at Albion.

● An "off-beat" location, C. J. Simpson 1 Sponseller, NW NW NW 4-6s-2w, Adams Township, Hillsdale County, flowed 65 bbl. oil in 95 minutes through tubing at 4,099 ft. Trenton logged at 3,555 ft. Simpson, Ambassador Oil Co., and Ohio Oil



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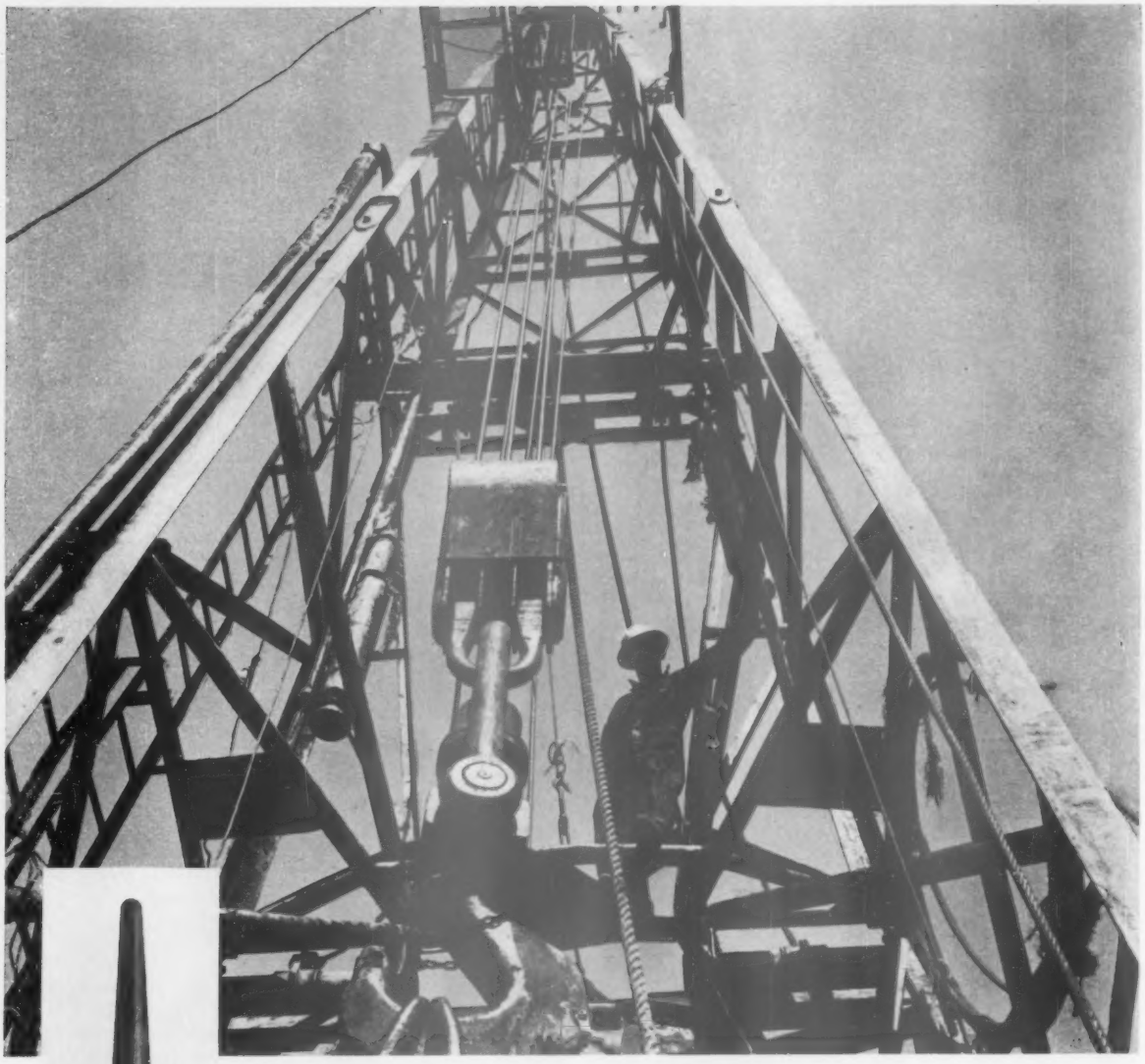

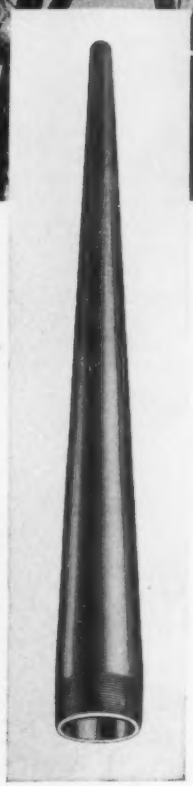

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Co. control the bulk of the acreage in the area.

The Simpson wildcat is located 1½ miles north of a disappointing 4-mile southeast extension of the Scipio trend. Two wells, offsets, are producing contrasted to 13 dry holes in the immediate area. The new prospect is 3 miles from the nearest producing wells in Scipio but over a mile east of the "ruler" trend that has held fairly constant up to the present.

Devonian gas flows at New Mexico wildcat

A Devonian gas discovery at 6 Bell Lake Unit, 4 miles north of Bell Lake field, flowed 9,389 M.c.f.d. during drill-stem test at 14,603-65 ft. in the Devonian. It is a Continental Oil Co. 17,000-ft. wildcat in southern Lea County, Southeast New Mexico, 20 miles southwest of Eunice.

A drill-stem test at 14,663-14,745 ft. got 1,047 M.c.f.d. A test at 14,747-14,835 ft. got 5,740 M.c.f.d. A test at 14,514-14,603 ft. got 4,275 M.c.f.d.

Bend Pennsylvanian strike in New Mexico

Bend Pennsylvanian gas-condensate production is hinted at a wildcat in the southwest part of Lea County, Southeast New Mexico.

The indicated discovery is Ohio Oil Co. 1 Lea Unit, a 15,000-ft. wildcat 15 miles southwest of Monument in 12-20s-34e, 2 miles southwest of Pearl field. Gas flowed on drill-stem test at the rate of 3,331 M.c.f.d. through ¾-in. choke from perforations at 12,765-12,811 ft. in upper Bend. Recovery was 990 ft. of condensate and 20 ft. heavily oil and gas-cut mud.

Another Clinton pool likely for Ohio's Perry

Indications of another Clinton pool opener in Perry County has been reported by Raymond C. Walsmith et al., operators.

The test, located west of Bristol, 1 R. C. Walsmith, Section 30, Pike Township, had 3,100 M.c.f. natural while still in the Clinton sand from 3,220-32 ft. Initial rock pressure gage was 1,080 psi.

Hoosier Oil & Gas Co. reports their 2 R. D. Barcus, Sec. 12, Harrison Township, Knox County flowed 180 bbl. oil per day in the first 24-hour test after fracturing. The stepout, near Pipesville, logged the Clinton sand at 2,734-55 ft. and had a show of gas and 2 bbl. oil natural.

Cass County, Texas pay moves westward

A farther westward stepout is being made by Shell Oil Co. in extending its exploration of Smackover possibilities in the Bryans Mill area of northern Cass County, in northeastern Texas.

The new stepout test is the third started by Shell since it completed its Smackover discovery well last March. All three still are drilling. So far the discovery has not been confirmed.

Newest test, 1 Jim Brock, is 3 miles northwest of the discovery well, 1 Allsup. It is 3,500 ft. west of Shell's 1 Lasater, first test started following completion of the discovery well, and now nearing the discovery well's Smackover pay at 10,297-10,367 ft.

Shell's other active operation, 1 Annie Brock, is 4,300 ft. southeast of the Lasater location, between it and the discovery well. It is 14,300 ft. northwest of the discovery well.

All three tests are scheduled to go to 12,000 ft. Lecuno Oil Co., of Jefferson, Tex., is drilling Shell's newest stepout venture. Travis Ward, of

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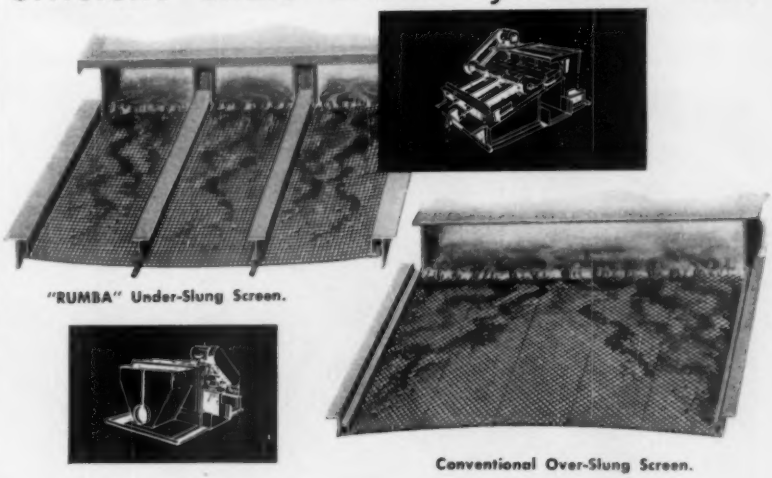

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Athens, Tex., is on the Lasater. Jet Drilling Co., Inc., Denver, is contractor on the Annie Brock test.

Ellenburger oil flows at shallow Texas site

Good Ellenburger Cambro-Ordovician production is reported at a wildcat in Archer County, North Texas. Jack Grace Production Co. opened Doodle Ellenburger field at 1-103 Petrex in a shallow producing area.

The well flowed 936 bbl. of 44°-gravity oil daily on 11/64-in. choke from Ellenburger perforations at 4,992½-5,000½ ft. Top of pay was 4,992½ ft. Location is in Section 103, ATNCL Subdivision, J. L. Chambers Survey, A-64, 6 miles south of Mankins and 6,000 ft. southwest of O'Donohoe Caddo Ellenburger field.

Dual Wilcox discovery finaled in Texas area

A Shell Oil Co. well, the 36 Plow Realty Co. in Sheridan field, Colorado County, Texas, flowed 1 M.M.c.f.d. from Wilcox perforations at 10,490-10,615 ft. to give a January discovery well its lower pay zone.

In January, the upper zone made 14,500 M.c.f.d. on tests. Wilcox P-5-Q pay was at 10,157-10,380 ft. Well is 4 miles southeast of Sheridan on the Francis Mayhar Survey, A-400.

Old Texas field is revived in Wilson County

Lower Wilcox gas pay reopened abandoned Denhawkin field in Wilson County, South Texas. Discovery well is Forest Oil Corp. 1 Mrs. T. D. Manford, 8 miles southeast of Stockdale in the Jose F. Rodriguez Survey, A-263.

The well flowed 6 M.M.c.f.d. with some condensate from perforations at 4,374-79 ft. It lies north of two depleted oil wells which produced at 4,270 to 4,290 ft. in Wilcox pay.

Texas' Waters field adds second producer

The second gas well for Waters field in Hidalgo County, South Texas, is Woods Exploration & Producing Co. 1 R. N. Waters Unit. It confirms the new field 6 miles south of Donna.

The well is a north offset to Geochemical's discovery well on the Brown Tract of La Blanca Grant. Flow was 2,164 M.c.f.d. on ¼-in. choke from perforations at 6,003-17 ft. Calculated open-flow potential is 3,900 M.c.f.d.

Texas' Hockley County adds new discovery

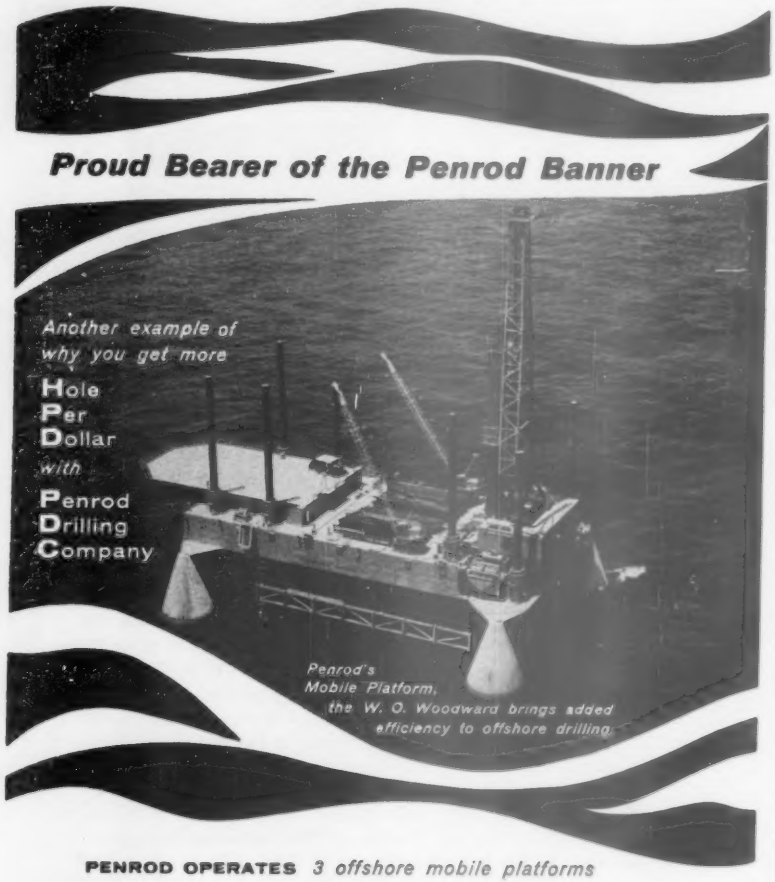
Clear Fork Permian oil production is reported at a wildcat in southern Hockley County, West Texas. The well is R. H. Fulton, 1-2 Williams, 7 miles south of Levelland in Labor 2, League 33, Baylor CSL Survey, 1¼ miles north of Clauene field.

The discovery pumped 146 bbl. of 28°-gravity oil plus 25% water in 24 hours from perforations between 6,320 to 6,500 ft.

Midland County field adds north extension

Azalea-Devonian field in northern Midland County, West Texas, added a good north extension. The well is Texas Pacific Coal & Oil Co. 1-D O. H. McAlister, 1 mile north of production in Section 32, Block 37, T-I-S, T&P Survey, 1 mile southwest of Germania.

The calculated absolute open-flow potential was 11 M.M.c.f.d. plus 180 bbl. condensate in 12 hours on 49/64-in. choke. Production is from Devonian perforations at 11,356-86 ft.



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Texas drillers dig deep in Rio Grande Valley

Lower horizons in the Starr County portion of Texas' Rio Grande Valley are to be evaluated in an ultradeep test being started by Austral Oil Co.

The test, 1 Jennie V. Sanchez, in Porcion 73, Jurisdiction Camargo, is 15 miles northwest of Rio Grande City in the southwestern part of the county.

It is 2 miles northeast of Alvarez field, one of a trend of small, shallow (750-ft.) Hockley-sand producing areas.

Projected depth is 13,000 ft., which, if reached, will make the test the deepest yet drilled in the county.

West Texas field gets confirmation

A newly opened field in Ward County, West Texas, was confirmed last week by Blue Danube Oil Co. The second well in Miller Block B-29 Pennsylvanian field, 16 miles south of Monahans, is 1 Jane Dean Miller. It flowed 190 bbl. of 38°-gravity oil per day on 11/64-in. choke. Perforations were at 7,964-8,098 ft. Location is in Section 15, Block B-29, PSL Survey. The discovery well was Gulf Oil Corp. 1 Jane Dean Miller. It is 1 location northwest.

Discovery reported in North Texas area

Mississippian oil production was opened 1 mile west of Regular field production in Archer County, North Texas. The discovery well is Hayden Farmer 1 Maxey in the J. Longley Survey, A-780.

The well flowed 382 bbl. of oil per day from perforations at 5,250-60 ft. on 16/64-in. choke. Nearest comparable production is in Regular field, 1 mile east.

Texas' Sabine Lake gets second producer

The second productive well to be drilled in the Gulf Coast's large Sabine Lake has been completed to confirm a discovery by Shell Oil Co. last August.

The new well, designated as 2 State Lease 3460, may be in a different sand than that productive in the discovery well, 1 State Lease 3459.

Its pay is perforated at 10,892-10,902 ft. as compared to that at 11,070-80 ft. in the first well. Flow through 20/64-in. choke was at the rate of 1,450 M.c.f. of gas and 12 bbl. of 57.8°-gravity condensate per day. Flowing pressure was 1,000 psi. Hole was drilled to 12,500 ft.

Location is ½ mile southeast of the first well. It is 3,700 ft. south of a dry hole which Shell has drilled since completion of the discovery well.

The new field, North Sabine Lake, is on the Louisiana side of the lake, which marks the Louisiana-Texas boundary.

Archer County wildcat is new Texas discovery

Southeastern Archer County, North Texas, has a new oil discovery. It is Gulf Oil Corp. 1 W. J. McMurty et al., 6½ miles northwest of Markley townsite in the Miguel Galan Survey, A-137, 6,500 ft. south of WGS Mississippian field.

The well flowed 838 bbl. of 33°-gravity oil daily through open hole on 22/64-in. choke. Top of the pay was at 5,374 ft.

Canyon is new pay for Texas' Aspermont area

The Canyon Pennsylvanian sand is a new producing horizon for Aspermont Ellenburger and Strawn field in Stonewall County, West Central Texas.

Texas Pacific Coal & Oil Co. 1 I. S. McMillin A/C 6, Section 20, Block U, T&P Survey, 7 miles south of Aspermont townsite, flowed 275 bbl. of oil daily on 20/64-in. choke from perforations in the Canyon sand at 4,354-64 ft.

Robert L. Folk receives President's Award

Robert L. Folk, associate professor of geology, University of Texas, Austin, has been selected to receive the President's Award, Lewis G. Weeks, president of AAPG, has announced. Formal presentation of this award, consisting of a certificate and $100 in cash, was made April 26, 1960, at the AAPG's forty-fifth annual convention in Atlantic City, N. J.

Each year the President's Award is given to the author, or authors, under the age of 35, whose article in the Association's "Bulletin" of the preceding year, as judged by the medal-award committee, is considered the most significant contribution to petroleum geology. Dr. Folk's award-winning article, "Practical Petrographic Classification of Limestones," appeared in the January 1959 issue. This paper was first presented, in a somewhat modified form, before SEPM during the 1957 joint AAPG-SEPM annual meeting in St. Louis.

Dr. Folk's article discusses the constituents of limestone, the principles of the rock classification scheme, characteristics of the 11 basic rock types, and summarizes the effect of recrystallization in limestones. As the title points up, the emphasis is on the practical, although not in the sense of a "cookbook or calculating machine" approach.

Folk attended Pennsylvania State College, receiving the BS degree in 1946, the MS degree in 1950, and the PhD degree in mineralogy in 1951. From 1946-50 he was assistant and instructor of mineralogy at Pennsylvania State College. He was a research geologist for Gulf Research and Development Co. from 1951-52. Since 1952 he has been a member of the geology faculty of the University of Texas. He is an associate member of SEPM, a member of Sigma Xi, and a fellow of the Geological Society of America.

Discovery wells

NEW MEXICO

Lea County:

Carper Drilling Co., Inc. 1-B Fee (MA), 6 miles southeast of Maljamar in 31-17s-33e. IPP 42 BOPD. 378 BSWPD, 37°, Delaware sand 4,720-40 and 4,750-89 ft. TD 9,020 ft. New oil discovery ½ mile southwest of East Maljamar field.

Sun Oil Co. 1 M. J. McNulty, 6 miles northwest of Crossforads in 3-9s-34e, 4 miles northwest of 10,025-ft. dry hole and 7 miles west of Bough field. IPF 207 BOPD, 14/64-in. choke, 47.6°, Bough C 9,604-14 ft. TD 9,633 ft. New oil discovery.

WEST CENTRAL TEXAS

Callahan County:

A. J. Frazier et al. 1-15 Elmer Jackson, OWPB, 6 miles north of Baird in Sec. 15, ETRR Sur. IPP 4 BO and 9 BWPD, 38°, 837-47 ft. TD 1,238 ft. New oil discovery.

Shackelford County:

Western Oil Development Co. 2-381-B Walker-Buckler Trust, 15 miles northeast of Albany in Sec. 381, TE&L Sur. IPP 4 BOPD, 37°, open hole top pay 357 ft. TD 462 ft. New oil discovery.

Stephens County

Gus C. Henson 1 State Lease 59794 (was Eldorado Oil & Gas Co.), 13 miles north of Breckenridge in W. H. Robertson Sur. IPF 328 BOPD, 30/64-in. choke, 40.6°, Marble Falls 4,178-93 ft. TD 4,468 ft. New oil discovery.

Throckmorton County:

B. William Payne 1 Parrott Estate, 3 miles north Woodson in Sec. 976, TE&L Sur. IPP 63 BOPD, 42.2°, 3,594-3,600 ft. TD 4,628 ft. New oil discovery.

OHIO

Muskingum County:

John Adams 1 Carl Ro. Eppley, Lot 5, 1 Qt., Falls Twp. IP 1,900 M.c.f.d., Clinton 3,541-81 ft. Rock pressure 939 psi. TD 3,581 ft. New gas pool.

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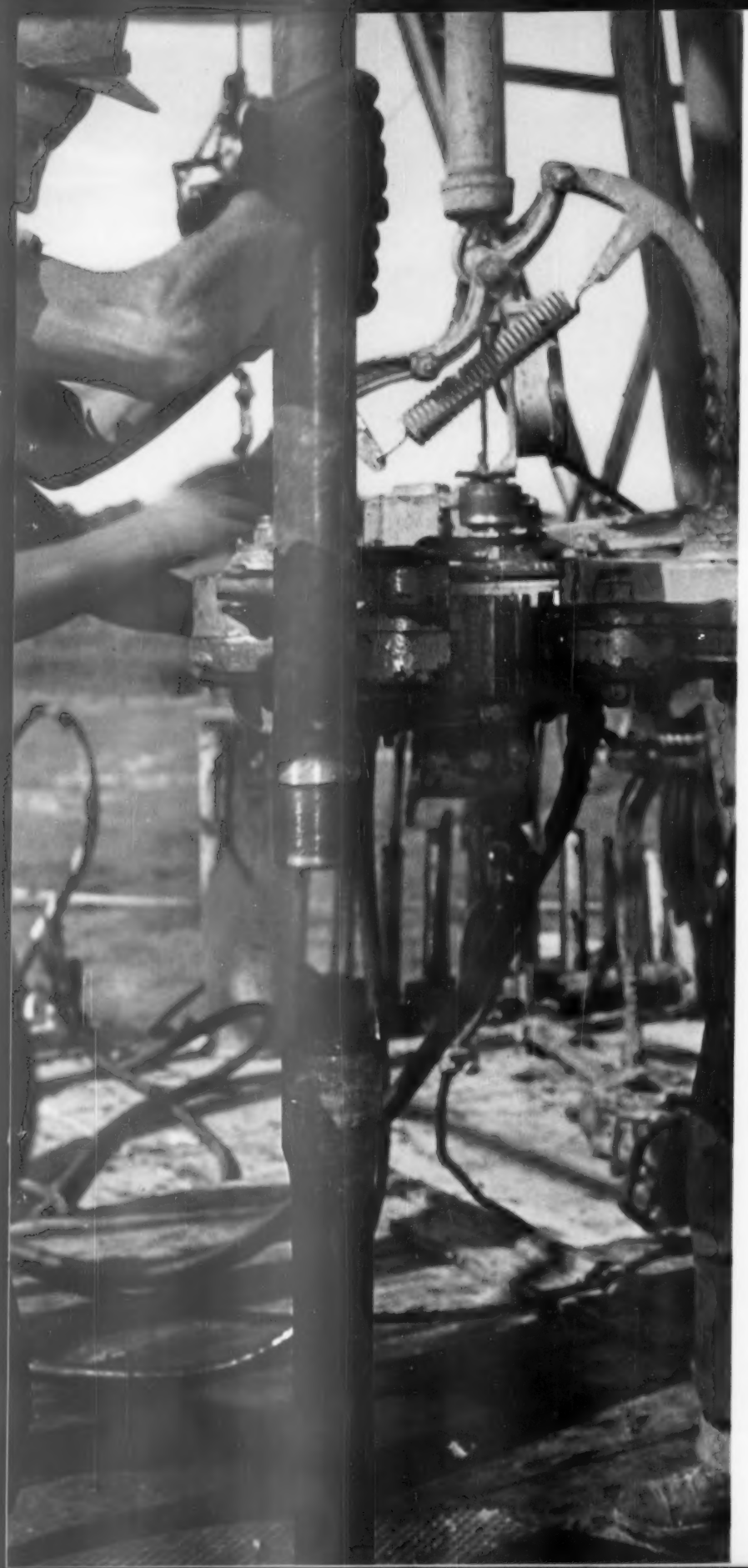
New tubing size meets needs of Multiple Completion Wells

Reports from field users verify successful performance of Spang's new, small size tubing in multiple completion wells. The 2 1/16" OD tubing is now available with integral joint (upset) and threaded and coupled joint (non-upset). Respective nominal weights are 3.25 and 3.20 pounds per foot. Both types are supplied in grades J-55 and N-80. Your nearby National Supply representative has complete details. Call him soon.

This integral joint Spang tubing is readily available in grades J-55 and N-80. Tubing is always delivered in factory-perfect condition.

◀ Spang's new leak-resistant 2 1/16" OD tubing was specified for this East Texas multiple completion well.



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Spang Extreme Line tubing is available in grades J-55, N-80 and P-105 to meet your toughest well conditions. It rounds out Spang's complete line of tubing for specific applications. Your National Supply representative always can recommend the exact Spang tubing that suits your requirements. Or write for new bulletin covering complete details.

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TESTS AND INSPECTIONS All Spang pipe is thoroughly inspected and hydrostatically tested for strength. Each length is easy to cut, bend, thread and weld.

AVAILABILITY National Supply has the manufacturing and distribution facilities to assure availability of all pipe sizes—plain end or threaded and coupled—*when* you need them.

These are only a few of the reasons for the superiority of Spang CW pipe. And you get this special pipe quality without premium price. Call today for prompt delivery.

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Burton T. Mast . . . known as idea man for Trunkline Gas Co.

Pipeliner Has Cut Costs

. . . and stepped up gas movement by refusing off-the-shelf items when he felt something else could do a better job.

BURTON T. MAST is one of those men whose age surprises you. If you know him only by reputation, you figure him to be at least 60. His many contributions to the pipeline industry, you'd guess, would take at least 30 years to produce.

Burt Mast will be 41 this month. And he doesn't look any older either.

A product of Rice Institute, Mast got his early training at United Gas, put his engineering theories to work during 8 feverish construction years with Tennessee Gas, and really came into his own during the past 6 years at Trunkline Gas.

He is still at work on what he considers to be the Number 1 problem of the pipeline business: Cutting costs by designing systems using new materials which will transport more gas for the dollar spent.

The road up . . . Mast was born in Missouri, came to Houston when 16 years old, entered Rice a year later, and worked summers for United Gas Pipe Line Co.

He worked first as a laborer with United Gas, but by the time he got his mechanical-engineering degree in 1941 he was a full-fledged engineer. He spent 6 months at the Tallulah, La., compressor station and then another 6 months at the Shreveport general office.

With the war on, Mast worked 6 months as a plant utilities engineer at a government ordnance plant near Shreveport and then joined the Army Air Force as a second lieutenant engineering officer. Specializing in aircraft maintenance, he spent 2 of his 3 service years in England and France trying to restore to duty the planes that had been shot up over Europe. He ended the war a captain.

The burgeoning Tennessee Gas Transmission Co. at Houston had the good fortune of latching onto the 26-year-old veteran in January 1946 and within 3 years he had become supervising engineer for the company.

During 5 years in this job, Mast was responsible for overseeing more than a half-billion dollars worth of construction for Tennessee Gas. This included laying several thousand miles of pipeline.

When he got an offer to become chief engineer for Trunkline Gas Co. in 1954, he couldn't turn it down. He has bossed Trunkline's expansion programs since that time, including an $82-million looping and extension project now being completed. Last September he was rewarded with one of Trunkline's three vice presidencies.

Contributions . . . Burt Mast is a creative engineer who refuses to believe that available machinery is the best that can be produced.

He prefers to look at a job, decide what's needed, and then proceed to goad someone into producing it if it isn't available. Known as one of the industry's top thinkers, he prefers to call himself a "knothead" who won't accept off-the-shelf items when he knows something better is possible.

This approach has made Mast a definite force for progress in gas pipelining.

While at Tennessee Gas, he supervised the design of a twin-shaft gas-turbine installation—the first in the country.

He helped to change the concept of compression of gas with reciprocating compressors, an approach that is now basic for the industry. Referred to as "high-clearance cylinders," it doubled the amount of gas moving through a unit.

While at Trunkline he has helped to develop turbine-driven centrifugal compressors that can handle any compression ratio from 1.2 to 1.8. This series-parallel combination broadened the application of the centrifugal, giving it the flexibility provided only by the reciprocating compressor before. And it gave Mast another lever in his efforts to cut costs.

Mast also had a hand in applying a highly efficient four-cycle engine—previously not available for gas-pipeline equipment—to drive a reciprocating compressor. This resulted in higher fuel economy and over-all efficiency than with existing units.

Mast's newest project is strictly experimental, but, if successful, will be a real money saver. In October, Trunkline will install two very small high-speed gas turbines at a compressor station. The installation cost will be much cheaper than conventional heavy gas turbine compressor units, and they will lower the cost-of-service per horsepower. They may make possible the building of smaller compressor facilities and allow cheaper expansion by construction of low-cost boosters between existing stations.

●

F. H. Lacy, Jr., chief engineer in Honolulu Oil Corp.'s natural gas and gasoline department, has been promoted to manager, natural gas and gasoline division.

Herman J. Brenneke, product engineer in Mobil International Oil Co.'s product technical services division, has been appointed marketing manager in Central America. He will headquarter in Guatemala City.

BOYER

HAIDER

LAMONT

STOTT

PAGE

Jersey Makes New Foreign Operations Appointments

FIVE NEW vice presidents have been elected, and three regional coordinators appointed, by Standard Oil Co. (N. J.) in a reshaping of the organization pattern of its world-wide activities.

In the new pattern, the contact between the parent company and affiliates is based on a regional concept, rather than by separate countries or functions.

The new vice presidents, all of whom are Jersey Standard directors, and their new responsibilities are: Marion W. Boyer, who heads a new committee to advise the Jersey board on investments and investment policies; Michael L. Haider, Latin America; Peter T. Lamont and W. R. Stott, Europe, the Mediterranean area, and West Africa; and Howard W. Page, the Middle East.

Regional coordinators, who will act as executive assistants to the respective regional vice presidents are: W. A. M. Greeven, Europe, the Mediterranean area, and West Africa; M. W. Johnson, Latin America; and S. D. Turner, the Middle East.

The new arrangement will bring increased experience to bear on Jersey's worldwide business activity and will help the company maintain the most effective communication with affiliates, according to Monroe J. Rathbone, Jersey president.

R. L. Sielaff, general manager of Tennessee Gas & Oil Co.'s Rocky Mountain division in Denver, has been elected a vice president of the company and named general manager of the Canadian division. In Calgary he will succeed **O. W. Ward,** vice president, who has been transferred to Houston as production department manager. Ward succeeded **A. R. West,** who recently was transferred to Tennessee Overseas Co. **R. M. Stephens,** division production superintendent in Denver, has been promoted to general manager of the Rocky Mountain division, succeeding Sielaff. In other appointments, **W. T. Wells, Jr.,** district production superintendent in Shreveport, La., has been promoted to southwestern division production superintendent in Midland, Tex. He succeeds **J. P. Jacks,** who has been transferred to Tennessee Overseas as production superintendent for Chaco Petroleum, S.A., in Cochabama, Bolivia. **William Miskimins, Jr.,** district foreman in Shreveport, will succeed Wells there. **G. F. Daniels,** operations foreman in Shreveport, will replace Miskimins.

R. L. Staples, general manager of operations for Kaneb Pipe Line Co., has been elected vice president, operations, and a director of the company. Staples was project manager for Pipe Line Technologists, Inc., during construction of the Kaneb system. He will continue to headquarter in El Dorado, Kans.

Floyd D. Horn, foreman with Colorado Interstate Gas Co., has been transferred to Laverne, Okla., from Boise City, Okla. He will be in charge of operations in the area.

George S. Young, president of Columbia Gas System, Inc., has been elected chairman and chief executive officer. **Cecil E. Loomis,** senior vice president, will succeed Young as president. **George P. MacNichol, Jr.,** has been elected a director.

H. D. (Ike) Moore, president of Derby Refining Co., a division of Colorado Oil & Gas Corp., has been elected president of Jayhawk Pipeline Corp. Jayhawk is owned jointly by Colorado Oil & Gas and National Cooperative Refinery Association.

Dale Te Kolste, assistant general manager of Peoples Natural Gas Division of Northern Natural Gas Co., has been promoted to vice president and general manager of the division. He succeeds **Donald L. Sedgwick,** who has retired.

E. E. Clark, assistant to the vice president of Kentucky West Virginia Gas Co., has been named vice president in charge of operations. He succeeds **H. L. Ley,** who will take early retirement August 31. Clark will headquarter in Prestonburg, Ky. In other changes, **W. W. Wallen,** land agent, has been named operating manager. **L. E. Roberts,** plant superintendent of Kentucky Hydrocarbon Co. in Maytown, Ky., has been named assistant to the vice president of Kentucky West Virginia Gas. He will headquarter in Ashland, Ky.

L. D. Falls, connection foreman with Sinclair Pipe Line Co., has been transferred to Silsbee, Tex., from Bowie, Tex.

KAYSER

BOYD

LaFORCE

Paul Kayser, founder of El Paso Natural Gas Co. and president since 1928, has been elected chairman and chief executive officer. **Howard Boyd,** executive vice president, has moved up to president. **Arnold R. LaForce,** financial vice president, will succeed Boyd as executive vice president. Boyd has been with El Paso since 1952. He was elected a director in 1953 and executive vice president in 1957. LaForce joined the company in 1956 as financial vice president and a director.

▶▶▶ Personals

William O. Twaits, executive vice president of Imperial Oil Ltd., has been elected president and chief executive officer. He succeeds **J. R. White,** who has been named chairman. White has been nominated as a director of Standard Oil Co. (N. J.), the parent company. His election to the Jersey board is expected later this month. **Vernon Taylor,** a director and general manager of Imperial's producing department, and **L. D. Fraser,** a director, have been elected vice presidents of Imperial. **D. S. Simmons,** general manager of the manufacturing department, will fill the Imperial board vacancy when White moves to New York.

TWAITS

D. Carlton Jones, assistant manager of production for Hudson's Bay Oil & Gas Co., Ltd., has been appointed general manager of the production department. He succeeds **E. L. Shafer,** who recently was named assistant regional general manager for Continental Oil Co. in Denver.

J. W. Pittman, manager of Shell Oil Co.'s transport and materials department, New Orleans, has been named manager of the New Orleans production department. He succeeds **W. R. Lund,** who has been named Houston production manager. **M. L. Kerlin,** New Orleans area geologist, has been appointed exploration manager succeeding **G. A. Burton.** Burton has been transferred to Los Angeles as Pacific Coast area exploration manager. **L. E. Slagle,** transportation manager, will succeed Pittman.

A. A. Anders, West Texas production division superintendent for Continental Oil Co. in Midland, Tex., has been named superintendent of an enlarged North Texas-Panhandle division in Abilene, Tex. **F. T. Elliott,** superintendent of the old North Texas-Panhandle division in Wichita Falls, will succeed Anders in Midland. **C. C. Wilson,** district production superintendent in Borger, Tex., will be superintendent of a new Wichita Falls district. **Frank Jacobs,** Electra, Tex., district superintendent, will succeed Wilson. **S. T. Hoffman,** Bowie, Tex., district superintendent, has been transferred to Sweetwater, Tex., as superintendent of the district office moved there from Abilene. The former Bowie and Electra districts have been consolidated into the Wichita Falls district.

John G. Hurd, partner in Killam & Hurd, Laredo, Tex., producing firm, was named president of Texas Independent Producers and Royalty Owners Association last week at Tipro's annual meeting in Tyler, Tex. He succeeds **Harry Jones,** Kilgore. Other 1960 officers, all reelected, include **J. F. West,** Stamford, secretary; **Vance Foster,** Dallas, treasurer; and **W. E. Turner,** Austin, executive vice president. **Wallace E. Pratt,** Artesia, N. M., consulting geologist, received Tipro's annual "Hats Off" award during the convention.

Theodore R. Goebel, executive vice president of Columbian Carbon Co., has been elected chairman. He succeeds **Carl E. Kayser. George P. Bunn, Jr.,** general manager of the company's Mid-Continent oil and gas division in Houston, has been elected a vice president. He will be in charge of all domestic and Canadian oil and gas operations and allied processing activities. He will headquarter in New York. **H. Scott Thompson,** regional director of the land department in Houston, will succeed Bunn. **John S. Freeman,** former president and a director of Skelly Oil Co., has been elected a director of Columbian Carbon. **Harry D. Page,** general attorney, has been named secretary of the company. He succeeds **Frederick H. Stokes,** who will continue as a director and general counsel.

F. R. Dykstra, assistant chief geologist of West Canadian Oil & Gas, Ltd., has been promoted to chief geologist. He succeeds **J. K. Bryant.** Dykstra was with Pacific Petroleums, Ltd., before joining West Canadian in 1957.

J. J. Hohler, manager of Shell Oil Co.'s Houston division exploration and marine division exploration, has been named area geologist. **W. R. Cobb,** formerly on special assignment in The Hague, has succeeded Hohler as manager of Houston division exploration. **E. R. Sauermilch,** area geologist, has succeeded Hohler as manager of marine division exploration. In other changes, **G. B. Adams,** geologist in marine division exploration, has been named Houston division geologist. **P. D. Kaminsky,** geologist, has been transferred to the marine division from the Houston division. **P. L. Terrasson,** marine division geologist, has been named senior geophysicist, Houston area exploration. **C. B. Stone,** geophysicist, has succeeded Terrasson.

AAPG Honors Howe

Henry Van Wagenen Howe, right, Louisiana State University professor of geology, has received the Sidney Powers Memorial Medal, highest award of American Association of Petroleum Geologists. Lewis G. Weeks, left, Westport, Conn., consultant and president of AAPG, made the presentation at the recent AAPG-SEPM joint meeting. Howe was cited for his contributions to education and for his research work in paleontology.

NGAA Presents Five Recognition Awards for Industry Service

RECEIVING NGAA recognition awards at the association's annual meeting in Houston were, left to right, Cade C. Clover, American Meter Co., Tulsa; C. W. Miller, Warren Petroleum Corp., who accepted the award for Sam Hulse, Warren, Tulsa; L. L. Dresser, Dresser Engineering Co., Tulsa; Joe Miller, Humble Oil & Refining Co., Houston; and Harry Fiske, Ingersoll-Rand Corp., New York. The awards are made for industry service.

R. G. Parker, central region production manager for Continental Oil Co., has been promoted to assistant general manager of the central region. He will continue to headquarter in Oklahoma City.

George V. Ricks, assistant district superintendent for Atlantic Refining Co. in Great Bend, Kans., has succeeded **Stan Myers** as superintendent of the Kansas production district, Great Bend. Myers has retired.

L. W. Welch, Jr., has been named production division manager for Jersey Production Research Co. He succeeds **Edwin C. Holmer,** who recently was elected vice president and a director of the company. Welch was at one time an assistant manager of the production division. He will take over as manager September 1 after completing a special assignment with Imperial Oil, Ltd. **Dr. C. D. Russell,** head of the secondary recovery section, production division, has resigned to join Cie. Francaise des Petroles in Paris as head of reservoir engineering and technical service. **Dr. B. T. Willman,** now on special assignment with Esso Research & Engineering Co., will succeed Russell July 1 as section head for Jersey Production Research. **L. W. Ledgerwood, Jr.,** head of the drilling research section, drilling-development division, will become assistant manager, drilling-development division, June 1. **R. J. Howe** will succeed Ledgerwood as section head.

William R. Seuren has joined Murphy-Canada Oil Co., a subsidiary of Murphy Corp., as vice president, marketing. He will be manager of eastern Canada marketing properties of the company with headquarters in Toronto. Seuren had been sales vice president and a director of Frontier Refining Co.

▶▶▶ Deaths

R. C. Stewart, 79, retired head of production and drilling operations in Louisiana for Texaco Inc., died April 27 in a Lafayette, La., hospital. Stewart joined Texaco in 1908, 6 years after it was organized. He directed the company's pioneering work in development of Louisiana's inland water fields. He retired in 1946.

Simeon C. Clover, 84, retired Tulsa independent, died April 27 in a Vinita, Okla., hospital. Clover retired in 1935.

John J. Collins, former president of W. P. Collins Oil Co., died May 2 in Chicago.

Martin Benjamin Lane, Sr., 76, cable tool driller and later a supervisor in the production department of the old Chanslor-Canfield Midway Oil Co., now Chanslor-Western Oil & Development Co., died April 25 in Los Angeles.

Robert Fisher, 65, retired financial vice president of Texaco Inc., died April 28 in Tappan, N. Y., after a heart attack. Fisher retired last year after almost 50 years with Texaco.

Charles A. Nagle, 66, retired construction engineer for Southern California Gas Co., died April 24 at his home in Glendale, Calif.

Sir George Legh-Jones, 70, a managing director of Shell Transport & Trading Co. and a director of Shell Petroleum Co., died April 30 in London. He had been president of Shell Oil Co. of California and a managing director of the Royal Dutch-Shell group during his 40-year Shell career.

John Alexander Rothschild, 45, owner of Surf Oil Co., Hollywood, Calif., and assistant manager of Rothschild Oil Co., Santa Fe Springs, Calif., for many years, died April 29 in a Los Angeles hospital.

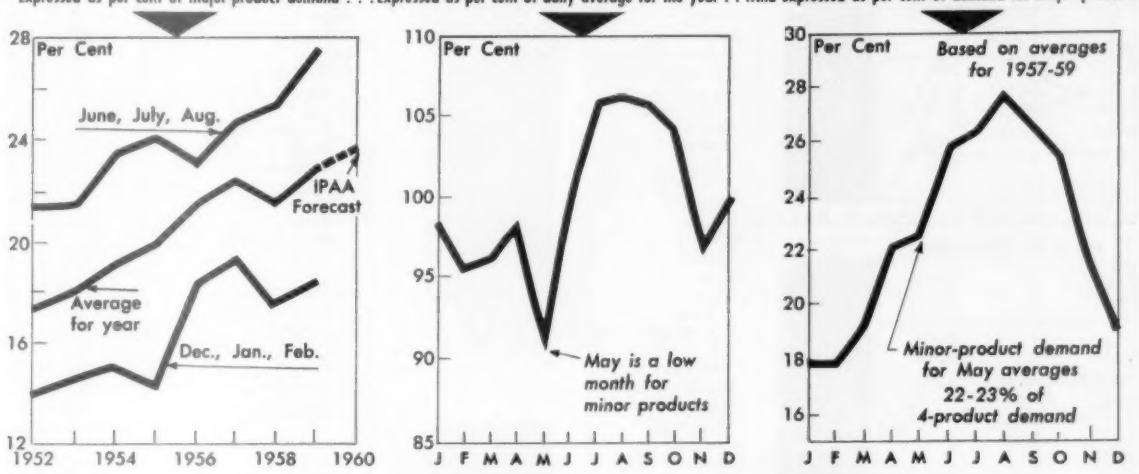
Chester Lee Sharp, 48, chief engineer for Johnson-Fagg Engineering Co., died of cancer May 3 at his home in Tulsa.

Stayton Willet Hamner, 77, retired Healdton, Okla., district supervisor for Schermerhorn Oil Corp., died May 4 at his home in Tulsa. Hamner retired in 1953.

Albert G. Harrell, 55, production superintendent for Continental Oil Co. in Seminole, Okla., died May 3. Harrell had moved to Seminole from Cherokee, Okla., a few weeks ago.

Total Demand For Minor Products . . .

Expressed as per cent of major-product demand . . . Expressed as per cent of daily average for the year . . . And expressed as per cent of demand for major products



Major growth for minor products

BY JOHN C. CASPER

RAPID GROWTH in demand for minor products has become an important factor in the gradual shift in processing at refineries, and refinery shifts produce changes in demand for certain types of crude.

Demand for these minor products is growing faster than total demand for all products. The term minor products includes all petroleum products other than gasoline, kerosine, distillate, and residual.

In this group, LP gas ranks first on a basis of volume. Still gas, used primarily as refinery fuel, is second. Asphalt and road-oil sales are in third place, followed in order by jet fuels and lubricants.

Total demand for minor products averaged 1,801,000 bbl. daily for 1959, just a little under the total for distillate fuels.

Growth in demand for minor products compared with major products is shown in the first chart. Note the middle line on this chart has only one break in the upward trend.

The lines on this chart express minor-product demand as a per cent of major-product demand. For the year 1952, demand for minor products was 17.5% of major-product demand. Last year the ratio was up to 22.9%. And, the latest forecast for 1960 by the IPAA Supply and Demand Committee estimated minor-product demand this year at 23.7% of major-product demand.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,039,155	UP	38,360	DOWN	104,040
Crude stocks	261,925,000	UP	3,000,000	UP	9,887,000
Completions	749	UP	26	DOWN	164
Refinery runs	7,945,000	DOWN	22,000	UP	243,000
Gasoline stocks	219,524,000	DOWN	2,028,000	UP	9,931,000
Kerosine stocks	20,024,000	UP	911,000	DOWN	1,052,000
Distillate stocks	81,375,000	UP	2,967,000	DOWN	4,209,000
Residual stocks	39,320,000	UP	507,000	DOWN	15,180,000
Four-product stocks	360,243,000	UP	2,357,000	DOWN	10,510,000
Total imports	1,738,100	DOWN	270,300	UP	296,900

The top and bottom lines in the first chart show that minor products play a more important role in summer than in winter. Last August, this ratio of minor to major products reached a new high of 29.3%. The low point for recent years was in February 1955 when the ratio dropped to 12.5%. For that month minor-product demand was only an eighth of major-product demand.

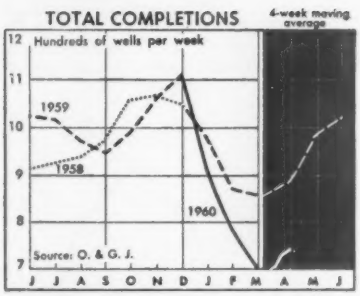
These seasonal changes in demand are shown by the line on the second chart. For the past 3 years, January demand has been about 98% of the daily average for the year. February demand is a little lower. Note that the low point for the year is in May.

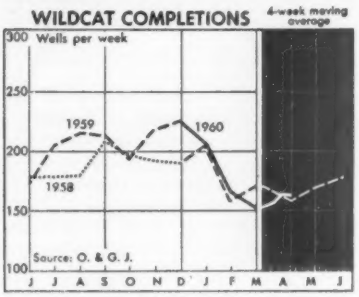
There is a plateau of demand during the late-summer months when the daily average for the period is about 6% above the year's average.

The last chart is a useful tool for those interested in estimating total demand from weekly API figures.

Daily average demand for minor products in January and February is a little less than 18% of major-product demand. The line climbs to a peak in August when the ratio is 27.5%. Note that for the month of May, demand for minor products will average 22-23% of major-product demand. And, current demand for major products can be estimated from weekly figures reported by API.

DRILLING





Active Rotary Rigs

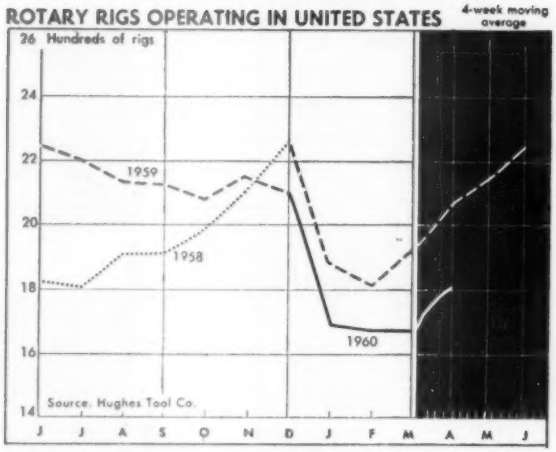
	5-2-60	4-25-60	5-4-59
Alabama	3	3	6
Alaska	5	5	(†)
Arkansas	11	14	15
Arizona	3	2	0
California	96	94	98
Land	91	88	94
Offshore	5	6	4
Colorado	28	30	26
Florida	1	2	3
Land	0	1	2
Offshore	1	1	1
Illinois	54	48	41
Indiana	9	6	8
Iowa	0	0	3
Kansas	115	134	140
Kentucky	6	4	9
Louisiana	280	286	352
North	33	34	34
S. Inland waters	112	118	149
S. Land	78	75	124
Offshore	57	59	45
Maryland	0	0	0
Michigan	29	13	19
Mississippi	70	73	54
Missouri	1	1	0
Montana	20	17	22
Nebraska	20	19	31
Nevada	0	0	0
New Mexico	122	117	115
New York	1	1	1
North Dakota	14	18	42
Ohio	4	5	3
Oklahoma	191	191	248
Oregon	0	0	0
Pennsylvania	15	12	12
South Dakota	0	0	2
Texas	629	620	785
S. Inland waters	11	10	7
S. Land	156	153	183
Offshore	1	2	1
North	43	43	176
Panhandle	50	55	(*)
East	61	62	(*)
West Central	188	187	263
West	119	108	155
Utah	24	25	28
Washington	0	0	0
West Virginia	3	4	6
Wyoming	55	52	65
Total U. S.	1,809	1,796	2,134
Western Canada	85	99	120
Eastern Canada	2	2	0
Grand Total	1,896	1,889	2,254

Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported 4-4-60.

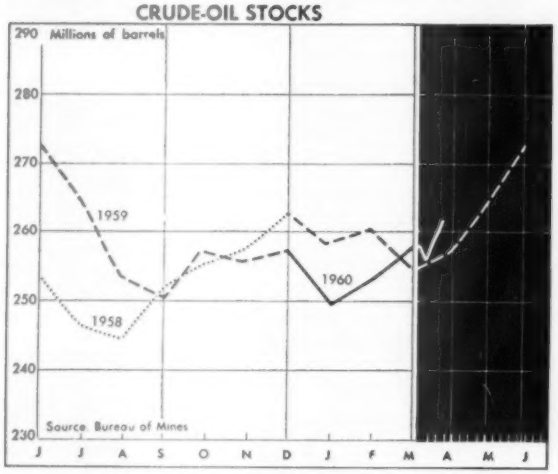
WEEKLY WELL COMPLETIONS . . . WEEK ENDED APRIL 30, 1960

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	0	0	0	0	0	0	0	17	37	0	0	0	0	0	1	5
Arizona	0	0	0	0	0	0	0	6	. . .	0	0	0	0	0	6	. . .
Arkansas	16	8	0	0	6	2	61,296	203	285	3	0	0	0	3	51	50
California	26	12	0	2	11	1	119,218	426	506	6	0	0	0	6	94	118
Colorado	7	4	0	0	3	0	34,891	224	243	2	0	0	0	2	105	145
Illinois	27	14	0	0	13	0	59,802	623	676	4	0	0	0	4	159	118
Indiana	20	7	0	0	12	1	23,089	289	213	3	0	0	0	3	118	73
Kansas	54	19	0	1	34	0	189,471	1,002	1,336	20	2	0	0	18	338	301
Kentucky	23	9	0	2	12	0	33,511	553	533	4	2	0	0	2	67	51
Louisiana	57	30	6	0	21	0	492,023	1,060	1,163	6	1	0	0	5	162	148
North	12	6	0	0	6	0	45,313	334	411	2	1	0	0	1	67	67
South	33	16	4	0	13	0	315,132	543	627	3	0	0	0	3	83	77
Offshore	12	8	2	0	2	0	131,578	183	125	1	0	0	0	1	12	4
Michigan	18	4	0	0	7	7	42,004	237	179	6	0	0	0	6	76	49
Mississippi	10	9	0	0	1	0	103,419	262	221	1	1	0	0	0	83	104
Montana	0	0	0	0	0	0	0	76	82	0	0	0	0	0	37	34
Nebraska	15	2	0	1	12	0	79,499	254	247	8	0	0	0	8	100	114
New Mexico	36	24	2	6	4	0	191,023	605	575	3	1	0	0	2	85	61
West	11	4	1	6	0	0	54,657	203	. . .	0	0	0	0	0	19	. . .
East	25	20	1	0	4	0	136,366	402	. . .	3	1	0	0	2	66	. . .
New York	0	0	0	0	0	0	0	100	117	0	0	0	0	0	7	8
North Dakota	3	1	0	0	2	0	22,662	100	152	0	0	0	0	0	17	32
Ohio	11	1	0	6	4	0	21,893	353	306	1	0	0	1	0	16	9
Oklahoma	69	30	0	7	31	1	350,639	1,218	1,969	15	3	0	1	11	227	305
Pennsylvania	0	0	0	0	0	0	0	185	163	0	0	0	0	0	7	3
South Dakota	1	0	0	0	1	0	1,729	15	. . .	1	0	0	0	1	6	. . .
Texas	305	179	11	8	99	8	1,351,964	5,271	6,344	58	4	0	0	54	1,072	1,198
District 1	35	23	0	1	11	0	112,877	387	402	10	1	0	0	9	135	101
District 2	19	10	1	0	8	0	129,362	230	267	5	0	0	0	5	55	79
District 3	27	9	3	2	13	0	190,519	406	365	4	0	0	0	4	77	90
District 4	15	4	2	0	9	0	115,350	387	395	4	0	0	0	4	110	110
East	17	8	0	0	9	0	69,381	395	374	6	0	0	0	6	81	80
District 7-B	55	29	1	2	20	3	135,193	773	884	14	1	0	0	13	226	230
West	75	59	0	0	13	3	382,532	1,399	1,966	7	1	0	0	6	223	241
District 9	43	28	0	0	13	2	119,479	962	1,214	8	1	0	0	7	140	225
District 10	19	9	4	3	3	0	97,271	332	477	0	0	0	0	0	25	42
Utah	5	0	0	0	5	0	34,335	96	125	5	0	0	0	5	35	36
West Virginia	24	1	0	17	1	5	59,308	258	237	0	0	0	0	0	2	6
Wyoming	21	10	0	0	11	0	118,157	311	263	11	2	0	0	9	130	85
Misc. (Fla.)	1	0	0	0	1	0	15,294	25	22	1	0	0	0	1	23	17
Total U. S.	**749**	364	19	50	291	25	3,405,227	13,769	15,994	**158**	16	0	2	140	3,024	3,070
Prev. week	723	359	29	47	277	11	3,263,111	. . .	. . .	166	19	1	12	134	. . .	. . .
Cum. 1960	13,769	6,434	449	1,140	5,352	394	60,810,069	. . .	. . .	3,024	267	32	94	2,631	. . .	. . .
Cum. 1959	15,994	8,064	426	1,134	5,944	426	67,370,111	. . .	. . .	3,070	312	44	103	2,611	. . .	. . .
Western Canada	29	18	0	4	7	0	191,508	771	793	4	0	0	1	3	234	297

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	4-23-60	4-16-60	4-25-59
Pennsylvania	2,119	2,114	2,435
Other Appalachian	1,647	1,695	1,641
Illinois, Indiana, Michigan	9,451	9,343	8,620
Nebraska and North Dakota	2,685	2,598	2,360
Kansas	9,785	9,918	9,251
Oklahoma	17,512	17,394	16,219
Arkansas	2,255	2,189	1,621
Louisiana	18,957	18,743	19,123
North	3,172	3,276	3,262
South	15,785	15,467	15,861
Mississippi, Alabama, Florida	2,282	2,372	2,349
New Mexico	7,510	7,725	7,525
Texas	113,685	112,802	110,529
East Texas	8,742	8,596	8,348
West Texas	50,959	50,725	54,016
Texas Gulf	21,053	20,591	17,471
Other Texas	32,931	32,890	30,694
Wyoming	17,708	17,643	13,954
Other Rocky Mountain	9,757	9,856	8,848
California	29,256	28,870	33,630
Foreign	†17,316	15,663	13,933
Total	**261,925**	258,925	252,038

*Bureau of Mines. †Includes 4,942,000 bbl. in California.

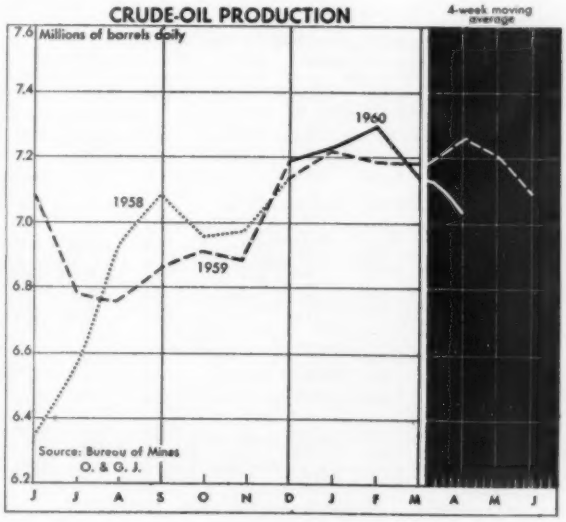
DAILY AVERAGE PRODUCTION FOR WEEK

	April 30, 1960			
	Crude oil	Lease condensate	Total	April 23 total
Alabama	19,350	.....	19,350	19,300
Arkansas	82,650	150	82,800	82,700
California	829,400	.....	829,400	828,500
Colorado	129,000	.....	129,000	129,600
Eastern	40,300	.....	40,300	40,000
Florida	1,100	.....	1,100	1,100
Illinois	212,800	.....	212,800	218,100
Indiana	32,500	.....	32,500	33,000
Kansas	†308,930	.....	†308,930	†300,120
Kentucky	64,300	.....	64,300	63,700
Louisiana	966,800	136,200	1,103,000	1,102,500
North	108,800	6,200	115,000	114,500
South	858,000	130,000	988,000	988,000
Michigan	32,700	.....	32,700	32,700
Mississippi	129,700	4,700	134,400	134,400
Montana	80,000	.....	80,000	79,400
Nebraska	61,800	.....	61,800	62,300
Nevada	100	.....	100	100
New Mexico	304,500	7,500	312,000	312,000
North Dakota	58,100	.....	58,100	56,800
Oklahoma	†544,400	.....	†544,400	†514,900
Texas	2,459,500	91,675	2,551,175	2,551,175
Dist. 1	41,500	3,700	45,200	45,200
Dist. 2	110,000	8,600	118,600	118,600
Dist. 3	311,000	38,000	349,000	349,000
Dist. 4	174,800	18,000	192,800	192,800
Dist. 5	27,500	500	28,000	28,000
Dist. 6	105,800	10,000	115,800	115,800
East Texas field	132,000	.....	132,000	132,000
Dist. 7-B	122,200	250	122,450	122,450
Dist. 7-C	120,100	3,225	123,325	123,325
Dist. 8	1,016,400	5,900	1,022,300	1,022,300
Dist. 9	191,200	2,400	193,600	193,600
Dist. 10	107,000	1,100	108,100	108,100
Utah	103,500	.....	103,500	103,000
Wyoming	336,100	.....	336,100	334,000
Others	‡1,400	.....	‡1,400	‡1,400
Total U. S.	6,798,930	240,225	**7,039,155**	7,000,795
Change from prev. week, up	.....	.....	**38,360**	.....
Canada	†506,400	.....	†506,400	†508,400

Total U. S. Prod.-Jan. 1-Apr. 30 ..... 866,906,600 bbl.
Same period last year (crude plus cond.) ..... *865,885,000 bbl.

*Includes 23,265,240 bbl. condensate. †Week ended previous Monday. ‡Alaska and South Dakota.

CRUDE-OIL PRODUCTION



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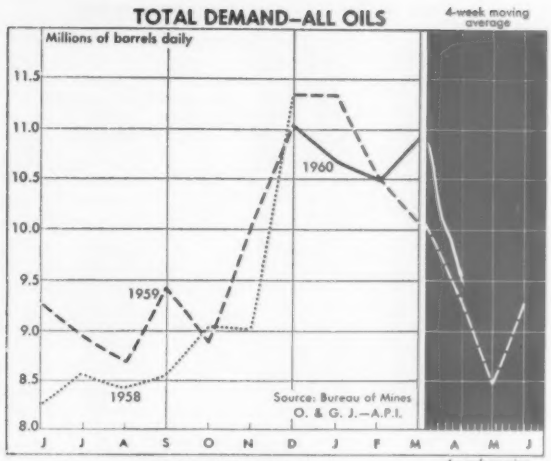
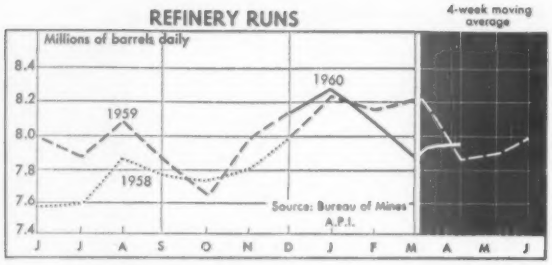
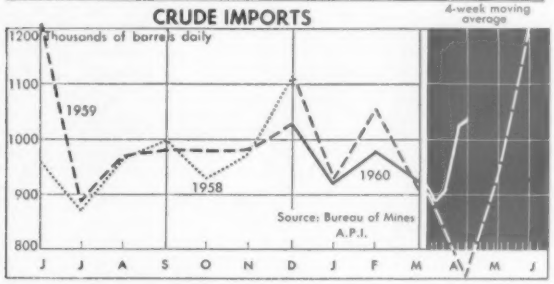
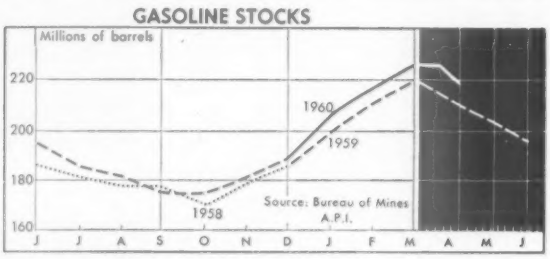
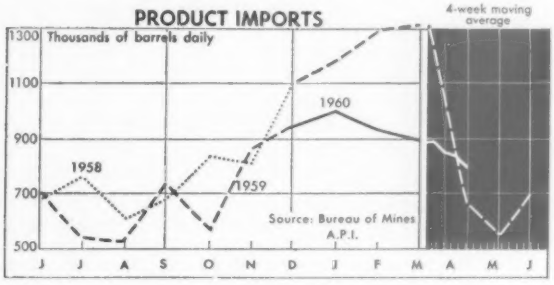
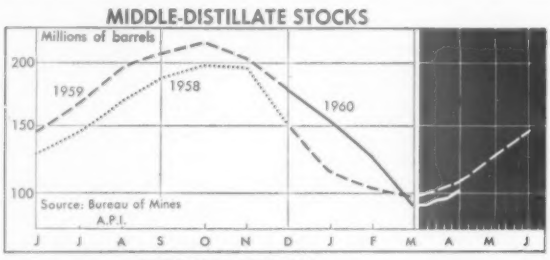


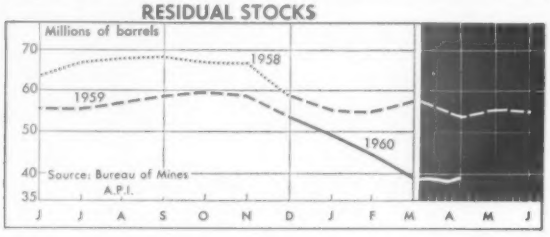












API REFINERY REPORT—APRIL 29, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, May 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,030	438.3	36.6	265.1	137.9	45,825	7,560	25,734	10,208	1,014	437.8	19.7	300.4	144.5
Appalachian:														
District 1	91	40.1	2.4	20.7	12.4	5,830	495	1,883	339	89	40.0	3.2	17.4	9.9
District 2	107	53.1	2.0	24.6	18.8	2,868	262	946	428	87	50.2	5.7	15.6	10.5
Ind., Ill., Ky.	1,479	727.6	69.4	292.6	183.3	42,364	3,841	13,519	3,886	1,437	743.8	60.9	272.7	156.8
Minn., Wis., Dak.	101	47.8	5.6	28.3	12.7	6,651	551	2,769	600	103	48.4	4.5	23.7	13.1
Okla., Kans., Mo.	704	350.0	19.3	146.1	15.1	21,587	851	6,843	909	713	396.1	8.7	169.4	18.6
Inland Texas	290	210.6	11.7	53.9	22.0	7,833	484	1,463	2,424	283	204.1	8.2	49.7	20.3
Tex. Gulf Coast	1,909	974.6	87.6	445.3	174.7	27,538	2,343	9,197	4,504	1,991	994.0	77.6	478.2	167.6
La. Gulf Coast	663	384.6	48.6	151.1	41.9	12,817	1,390	3,226	928	696	367.3	45.2	157.2	48.9
N. La. and Ark.	94	41.6	6.3	19.7	5.3	5,810	694	1,797	130	103	48.3	4.0	23.5	6.7
Rocky Mtn.:														
New Mexico	17	12.0	0.4	3.0	0.8	862	48	149	134	17	10.8		3.4	2.4
Other	262	106.6	1.4	60.0	33.3	7,512	236	2,419	964	244	112.6	2.5	52.9	31.5
West Coast	1,198	542.7	29.8	205.6	287.8	32,027	1,269	11,430	13,867	1,119	507.4	4.3	187.5	268.4
Apr. 29, 1960	7,945	3,929.6	321.1	1,716.0	946.0	219,524	20,024	81,373	39,321	7,896	3,960.8	244.5	1,751.6	899.2
Apr. 22, 1960	7,967	4,035.1	300.7	1,811.1	880.6	221,552	19.113	78,408	38,813					
May 1, 1959	7,702	3,877.3	249.0	1,767.9	936.0	209,593	21,076	85,584	54,500					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.76	....	....	....	....	....	....	....	....
15-15.9	1.84	....	....	....	....	....	....	....	$1.81
16-16.9	1.92	....	....	....	....	....	....	....	1.86
17-17.9	2.00	....	....	....	....	....	....	....	1.91
18-18.9	2.08	....	....	....	....	....	....	....	1.96
19-19.9	2.16	....	....	....	....	....	....	....	2.01
20-20.9	2.24	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.32	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.39	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	$4.70
Middle District	4.52
Southwest Pennsylvania	4.25
West Virginia	4.07
Buckeye Grade	4.07
Illinois Basin	**3.00**

Foreign

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.90
Iranian, 34.0°-34.9°, Bandar Masur	1.80
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57
Canada:	
Leduc-Woodbend	$2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 47°-47.9°, Tucupido	3.34
San Joaquin, 40°-40.9°, Puerto La Cruz	3.08
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

★ Gulf-NY, clean (ATRS −10%)	$2.57
★ Gulf-NY, dirty (ATRS −25%)	2.14
Carib.-NY. dirty (ATRS −55%)	1.24
PG-Japan, dirty (USMC −75%)	2.55

★ Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):	
★ Regular (91 octane)	10.25-10.50
★ Premium (99 octane)	12.75-13.25
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.00-10.25
Regular (92 octane)	10.25-10.50
Premium (98 octane)	11.00-11.50
California (rack) Los Angeles):	
Regular (88 octane)	11.65-12.15
Premium (94 octane)	12.65-13.15
Premium (100 octane)	14.00-14.65
Caribbean area (cargoes):	
Regular (87 octane)	10.00
Premium (97 octane)	11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):	
Kerosine 42-44	9.00-9.50
Diesel oil (58 d.i. and above)	8.75-9.25
Distillate No. 1	8.75-9.25
Distillate No. 2	7.75-8.25
Gulf Coast (cargoes):	
Kerosine 41-43	8.625-9.00
Distillate No. 2	7.625-8.00
New York Harbor (barges):	
Kerosine 41-43	9.8-10.3
Distillate No. 2	8.8- 9.3
Diesel fuel, 48-52 d.i.	9.1- 9.6
Caribbean area (cargoes):	
Distillate No. 2	8.00

Residual Fuel (Bbl.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.70-1.80
Gulf Coast (cargoes):	
Bunker C fuel	2.10-2.25
New York Harbor (barges):	
Bunker C fuel	$2.47
Caribbean (cargoes):	
Bunker C	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.15

★ Denotes change from previous week.

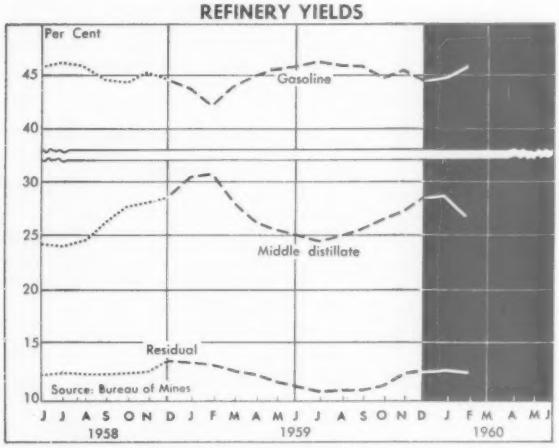
SELECTED MONTHLY DATA

SUPPLY AND DEMAND—MAJOR PRODUCTS
(Thousands of barrels daily)

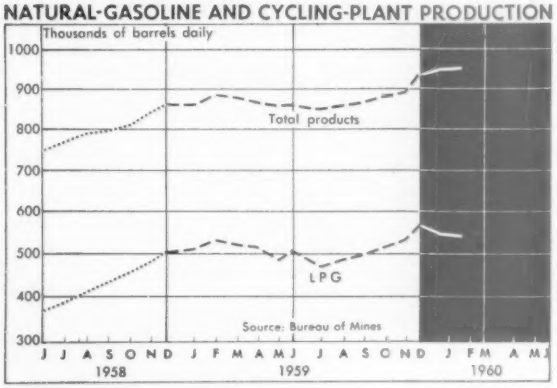
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
April 1960*	4,310	4,030	219,000
March 1960*	3,830	3,985	225,600
February 1960	3,786	4,119	217,139
May 1959	4,193	3,961	201,710
April 1959	4,239	3,886	210,395
KEROSINE			
April 1960*	245	338	20,400
March 1960*	525	350	17,540
February 1960	483	359	23,020
May 1959	132	245	24,535
April 1959	200	306	18,688
DISTILLATE			
April 1960*	1,595	1,770	82,000
March 1960*	2,800	1,810	75,120
February 1960	2,553	1,789	105,015
May 1959	1,279	1,752	101,816
April 1959	1,621	1,739	86,222
RESIDUAL			
April 1960*	1,600	945	39,000
March 1960*	2,000	1,015	39,110
February 1960	1,982	998	45,775
May 1959	1,342	899	53,961
April 1959	1,590	937	53,327

*Preliminary. †Thousands of barrels.

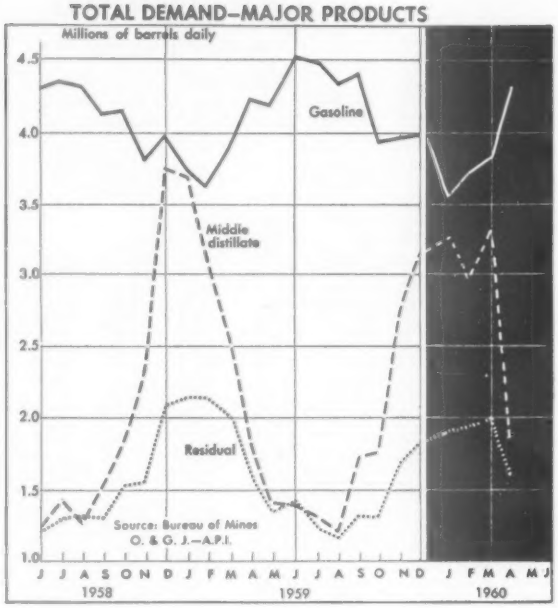
REFINERY YIELDS



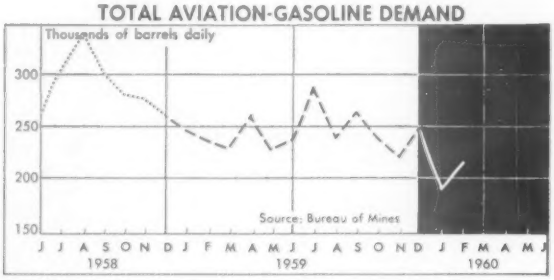
NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



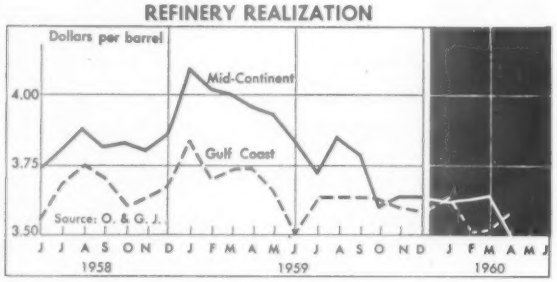
TOTAL DEMAND–MAJOR PRODUCTS



TOTAL AVIATION-GASOLINE DEMAND



REFINERY REALIZATION



REFINERY REALIZATION

	April* 1960	Mar.* 1960	Feb. 1960	April 1959
Mid-Continent	$3.50	$3.64	$3.59	$3.96
Gulf Coast	3.60	3.52	3,62	3.73

*Preliminary. Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel, and residual as published in The Oil and Gas Journal.

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SITUATIONS WANTED

GEOLOGICAL ENGINEER, 28, married, 5 years exploration experience in Mid-Continent area. Box L-809, The Oil and Gas Journal, Tulsa, Oklahoma.

LAND OR CONTACT job wanted with progressive company. 4½ years scouting experience, good knowledge land work, drilling deals, oil and gas law. BBA degree, 4609 Parkdale Dr., Apt. 3, Corpus Christi, Texas.

ADMINISTRATIVE secretary, 39, single, 10 years experience with major Venezuelan oil producer; desires relocate Latin America, but will consider other foreign employment. Box L-753, The Oil and Gas Journal, Tulsa, Oklahoma.

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PETROLEUM ENGINEER. P.E., M.S. Registered, 28, 5 years experience diversified, waterflood project supt., deal and evaluation work, employed as production supt. for independent in Venezuela. Preference for Latin America, but will consider other opportunities. 2501 Boyd, Ft. Worth, Texas.

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Atlas Powder Company

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PETROLEUM ENGINEER, B.S. Degree, age 28, three years field engineering experience with two large companies. Seeking challenging job with small company supervising drilling, completing and producing oil and gas wells. Will furnish experience resume, references and college grade transcript upon request. Military obligations completed. Box L-827, The Oil and Gas Journal, Tulsa, Oklahoma.

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P. O. Box 1260—Tulsa 1, Okla.

PRODUCTION FOR SALE

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CRUDE OIL purchasing Co. sales to major pipeline. Waste oil recovery. Lake Texoma, Oklahoma. Write Box 187, Kingston, Oklahoma.

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More discovery wells

(continued from page 254)

SOUTH LOUISIANA

Cameron Parish:

Sunray Mid-Continent Oil Co. 1 G. C. Rutherford, 29-14s-7w. IP 1,900 M.c.f.d. and 7 BOPD, 14/64-in., 48.5°, TP 1,900 psi., perf. 12,906-989 ft. TD 14.635 ft. Second well and new-pay discovery in South Creole field—2,750 ft. south of discovery well.

MISSISSIPPI

Amite County:

Larco Drilling Co. et al. 1 Paul A. Dykes et al., 21-4n-6e. IP 336 BOPD, 10/64-in., 42.2°, TP 2,100 psi., GOR 1,000 cu. ft. per bbl., perf. 11,062-68 ft., lower Tuscaloosa. TD 11,319 ft. Elev. 437 ft., Lower Tuscaloosa, 10,970 ft. Discovery well of Smithdale field.

EAST TEXAS

Smith County:

Robert F. Roberts 1 Elizabeth Jackson, Lewis H. Dillard Sur., A-827, 1½ miles east of Chapel Hill. IP 201 BOPD, 12/64-in., 38.8°, TP 650 psi., GOR 600 cu. ft. per bbl., perf. 7,678½-82½ ft., Rodessa. TD 7,743 ft. New pay in Chapel Hill field.

Wood County:

Mack Natural Gas Co., Hunt Graham, and T. J. Johnson 1 Willie Lee, W. Caison Sur., A-123, 2 miles southwest of Winnsboro. IPP 190 BOPD, 38.9°, GOR 520 cu. ft. per bbl., perf. 8,028-41 ft., Bacon sand. TD 8,827 ft. Extends Winnsboro field ½ mile southeast.

TEXAS GULF COAST

Calhoun County:

Humble Oil & Refining Co. 1 Florence M. Trull, Section 46, Theodore F. Koch Subd., James Hughson Sur., A-23, 7 miles northeast of Olivia. AOF 5 M.M. c.f.d., GLR 19 BC per M.M.c.f., 50.2°, shut-in TP 5,564 psi., perf. 8,060-80 ft., Frio. TD 8,800 ft. Discovery well Southeast Appling area.

Jefferson County:

Shell Oil Co. 40 McFaddin Trust 40, Sarah A. Pace Sur., A-783, 12 miles west of Sabine Pass. IP 86 BOPD, 8/64-in., 33°, TP 600 psi., GOR 1,849 cu. ft. per bbl., perf. 5,495-5,504 ft., Miocene, and (dual completion) 94 BOPD, 7/64-in., 30°, 500 psi., GOR 266 cu. ft. per bbl., perf. 5,182-87 ft., Miocene. TD 6,600 ft. New pays in Clam Lake field.

Live Oak County:

Coastal States Gas Producing Co. 4 Missouri Pacific, J. M. Colchada Sur., A-140, 3 miles south of Dinero. AOF 11 M.M.c.f.d., GLR 21.5 M.c.f. per bbl., 60.8°, shut-in TP 3,427 psi., perf. 5,832-36 ft, Cook Mountain, and (dual completion) 4 M.M.c.f.d., GLR 28.5 M.c.f. per bbl., 61°, 3,236 psi., perf. 5,716-24 ft., Cook Mountain. TD 6,010 ft. New pays in Mount Lucas field.

SOUTHWEST TEXAS

LaSalle County:

Sutton Producing Co. 1 Fidelity Philadelphia Trust Co., F. W. Johnson Sur., A-1390, 12 miles southeast of Cotulla. AOF 7,500 M.c.f.d., perf. 10,255-10,328 ft., Edwards. TD 10,501 ft. New deep-Edwards field, or 3-mile southwest extension of Cook deep-Edwards field.

Zavala County:

General Crude Oil Co. 1 Holdsworth, Section 35, Block A, AB&M Sur., A-54, 15 miles south of Batesville. IP 123 BOPD, 14/64-in., 34.8°, TP 115 psi., perf. 4,242-54 ft., San Miguel, TD 5,516 ft. New-field discovery.

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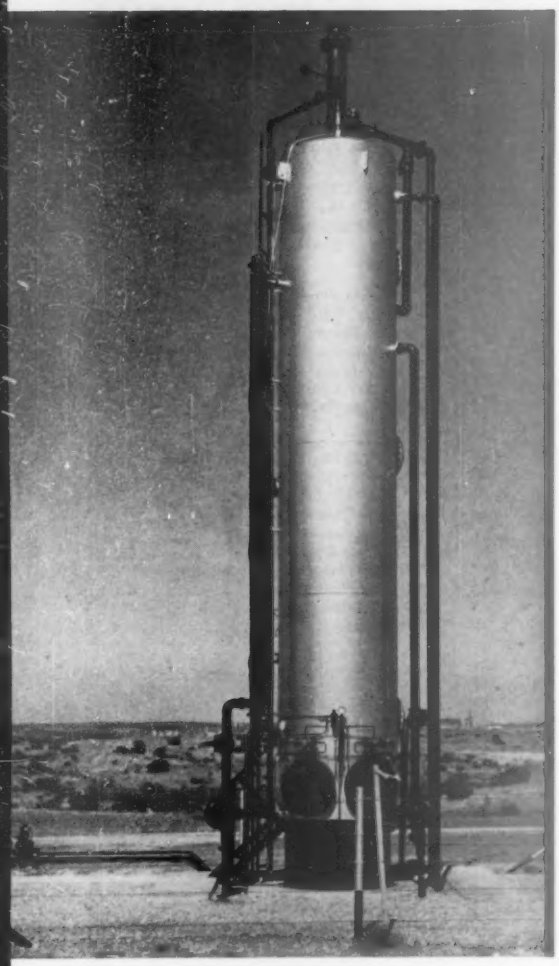

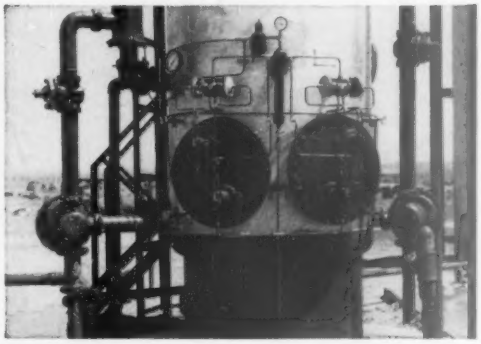

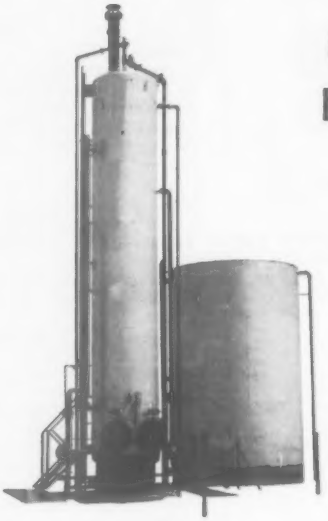

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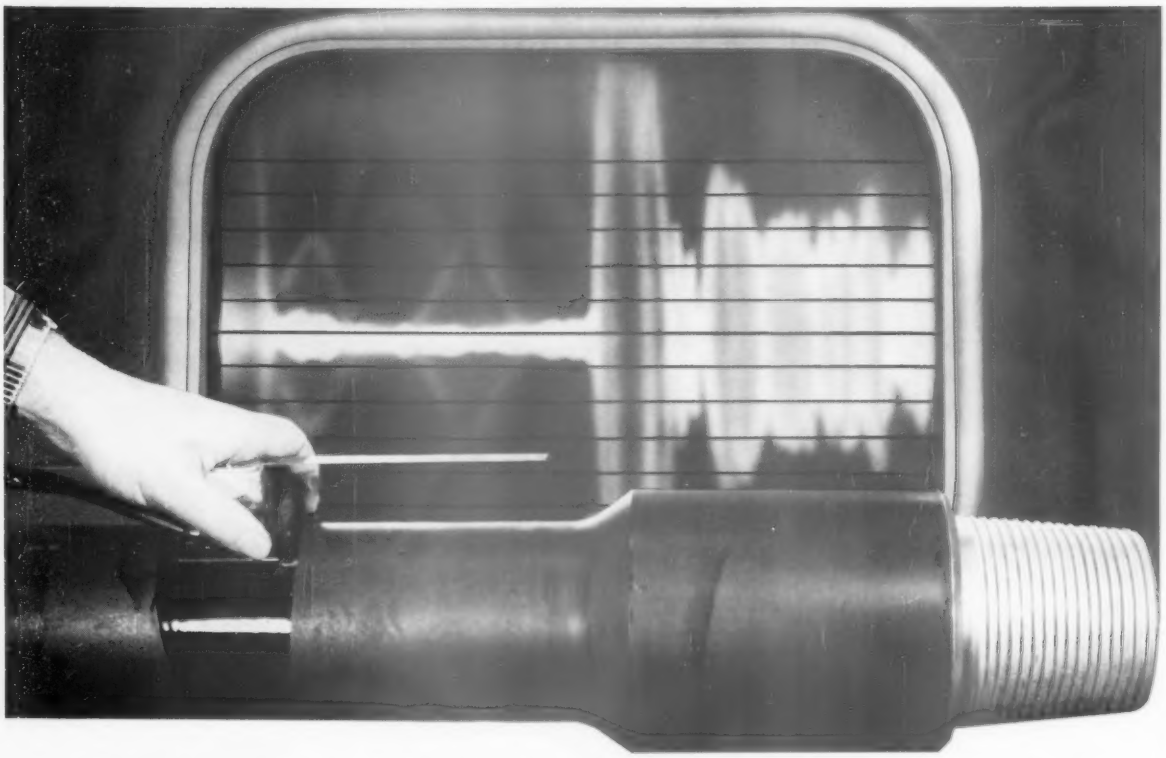

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